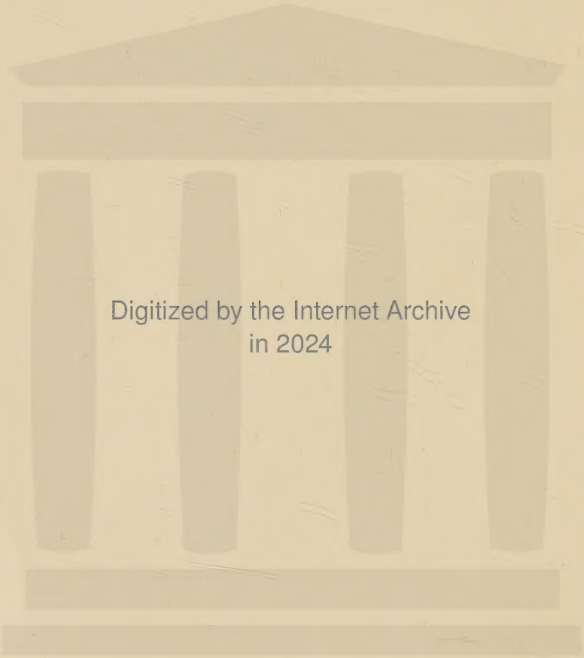
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THE NATURAL HISTORY OF HERTFORDSHIRE

THE NATURAL HISTORY OF HERTFORDSHIRE

BY

A. WILMORE, D.Sc., F.G.S., F.R.G.S.
ALBERT N. WILMORE, W. GRAVESON,
RICHARD MORSE, F.R.H.S.
W. BICKERTON, F.Z.S.

WITH SIXTEEN PLATES AND ELEVEN DIAGRAMS



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outdoors and who take an interest in their county may be led by reading it to know Hertfordshire better.

It is hoped that the questions, exercises, experiments, and suggested observations may prove helpful.

The Editor wishes especially to thank the Education Committee of the Hertfordshire County Council and Mr. E. F. D. Bloom, Inspector of Schools for Hertfordshire, for their interest in this new educational effort; without their encouragement and support the book would not have been written.

The writers of Sections I. and II. are responsible for the diagrams appearing in the text of their respective sections, and the writer of Section II. for the Physical Map which forms an end-paper to the book. The sources of the illustrations on Plates I. to VI. are indicated thereon: those on Plates VII. to IX. are from photographs by the writer of the Section on the Plants. Plates X. to XII. are supplied by the writer of the Section on animals, and are reproduced by the courtesy of Mr. A. R. Thompson, F.L.S., whilst Plates XIII. to XVI. are from photographs by the writer of the Section on Birds.

A. WILMORE (EDITOR)

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THE NATURAL HISTORY OF HERTFORDSHIRE

SECTION I.—THE ROCKS AND SOILS OF HERTFORDSHIRE

BY A. WILMORE, D.Sc., F.G.S., F.R.G.S.

CHAPTER I

THE ROCKS OF THE COUNTY: A GENERAL VIEW

LET us suppose that we can, like some magician in the old story-books, clear away all the vegetation and any other covering from the surface of our county. We will sweep away all the grass, the trees and flowers, the crops, and all the buildings. We shall then be able to see the soil in all its varied colour, reddish or brown, black or grey. This is not enough, however; we must go deeper still. Under the soil there lies what is called the "sub-soil," that is, the "under-soil," varying in thickness and appearance. This must be cleared away until the rocks underneath become exposed to view. It would seem very strange to see a country made up of bare rocks, and, in reality, such a thing is impossible in Britain; but it will help us a great deal if we can imagine it to be done.

Our county of Hertfordshire is seen to have a foundation or groundwork of three different kinds of rock, one of which occupies far more space than the others. First

of all, there are parts in the north and north-west, at Long Marston and Hexton, and near Ashwell, where Hertfordshire sends out lobes into Bedfordshire and Buckinghamshire ; here we should see a stiff blue clay with an irregular capping of sands. The clay which occupies the patches of low ground on the north-west of the county is called the **Gault** by geologists. In some districts, as at Arlesey, it has been largely dug for brick-making. The sand which lies in thin irregular beds on the top of the clay is called the **Upper Greensand.** This sand is much oftener yellowish or brownish in colour than green, but it was called the " Greensand " by the early geologists because it is often green in colour in the districts where they first studied it. The Gault Clay and the irregular Upper Greensand make up the first and lowest division of the rocks of Hertfordshire.

Right across the main part of the county there is seen greyish white **Chalk**—a very familiar rock in Hertfordshire. If we were looking down from an aeroplane we should see this Chalk occupying a sort of four-sided figure, with Tring, Royston, Ware, and Rickmansworth almost at its corners. If, for the purpose of description, we include in our survey part of that bay of Bedfordshire in which Dunstable and Luton stand, we may then draw almost parallel lines along the boundaries of the Chalk : the northern line would pass through Tring, Luton, Hitchin, Baldock, and Royston, the southern line through Rickmansworth, Watford, Hatfield, Hertford, and Ware. There will be no difficulty in following the boundaries of the Chalk region on the map, Fig. 1. The Chalk itself, as a rock, will be dealt with later.

In the south of Hertfordshire a second patch of clay would be seen, this time with some irregular sands and gravels underneath. This clay is the important " rock " which underlies so much of London, and on this account

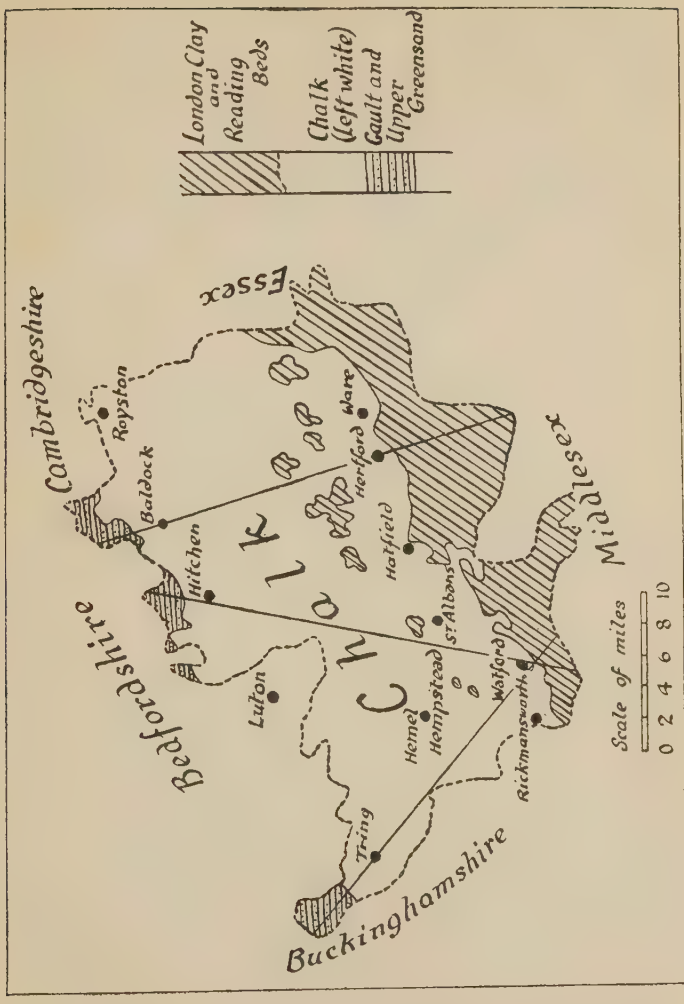


FIG. 1.—Geological Map of Hertfordshire.

is called the **London Clay.** It continues beyond the southern boundaries of the county underneath the whole of Middlesex, the northern parts of Surrey and Kent, and much of Essex. The sands and gravels which have just been mentioned as being under this clay are known as the **Reading Beds;** these will be studied more fully later. For the present the main point is to see that there are three formations or groups of rocks which make up the foundation of Hertfordshire ; they are as follows :

LONDON CLAY.
READING BEDS.

THE CHALK.

UPPER GREENSAND.
THE GAULT.

Every reader should find out on which of these chief divisions his or her home and school are situated. The map should be thoroughly mastered and continually used in later parts of the book.

In order to understand the build of the county more thoroughly we will draw what is called a Section through it, from the northern to the southern boundary, right across the three main rock groups which have been mentioned. On the map, Fig. 1, three straight lines have been drawn across the county, the first through Baldock and Hertford, the second through Hitchin and Watford, and the third through Tring and Watford. The section may follow any one of these lines, because the result would be very much the same in any case. We are imagining that we can cut a section down through the rocks until we reach sea-level, somewhat as we cut through some of the cakes with different coloured layers which we often see on the tea-table. A diagram of such a section is given in

Fig. 2. Let us examine it and see how we can better understand the build of the county.

Beginning on the northern border of the county, slightly to the north of any of the three towns mentioned, we are on low ground, and here is the Gault Clay with its irregular covering of Upper Greensand. As the section approaches the Chiltern Hills the Clay and Greensand are seen to pass under the Chalk ; or, in other words, the Chalk lies on top of the Greensand and Gault Clay. (See point marked X in the Section.) Near Baldock or Hitchin or Tring the section reaches the Chalk Uplands, and in each case our

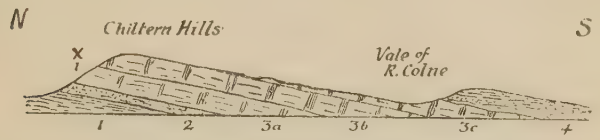


Fig. 2.—A Section across Hertfordshire from North to South (see the lines on the map). Distance about 24 to 28 miles.

4. { London Clay. / Reading Beds.
3c. Upper
3b. Middle } Chalk.
3a. Lower
2. Upper Greensand.
1. Gault.

line soon takes us on to the rounded hills called the Chilterns, which are dealt with more fully in a later part of the book.

We have risen from the low ground of the Gault Plain to the Chalk Uplands rather sharply, and it is easy to see that we have gone up the cut edge of the Chalk strata. Such a cut edge of rocks is called a scarp, and these scarps are among the most prominent features in south-eastern England.

After reaching the higher parts of the Chalk Uplands we begin to descend towards the south very gently, and in many a quarry or chalk-pit or other cutting the beds of

the Chalk are seen to be dipping or sloping towards the south. In following the line of section to the south we are going down what is called the dip-slope ; it is important that the difference between the two slopes of the Chilterns —the northern one and the southern one, or the scarp face and the dip-slope—should be clearly understood.

After nearly 20 miles of this Chalk country, passing down the dip-slope, we reach the long, wide "valley" which runs across the county from Rickmansworth to beyond Ware, and in which the rivers Colne and Lea flow west and east respectively. This valley is clearly shown in the map which forms an end paper to this book. The Chalk can be seen passing *under* the next set of beds, of

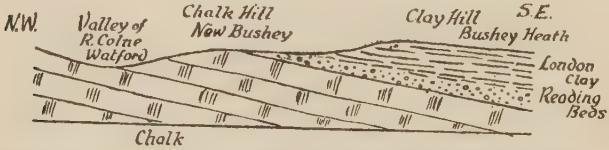


FIG. 3.—A Section from Watford High Street to Bushey Heath along the London Road.

which the chief member is the well-known London Clay. We must be quite clear about the relation of these rocks; the London Clay lies *above* the Chalk ; the Gault Clay lies *under* the Chalk ; there should be no mistake about the order of these beds.

A particular illustration from Watford may now be taken which will help to bring out the succession of these strata more clearly. If a cyclist travels southward on the London road from the bridge in the High Street, near the Gas Works, where the river Colne passes under the main road, he will begin to climb almost immediately, and if he inquires he will find that the gently sloping hill is called "Chalk Hill." After he has climbed to the top of this gentle rise and then travelled "on the level" for less

than a mile, he finds another and a sharper rise which is called " Clay Hill " ; here he is rising to the surface of the London Clay at Bushey Heath. He has thus travelled right across the junction of the Chalk and London Clay. The diagram-section, Fig. 3, will help the reader to understand the sequence of rocks at Watford and Bushey.

The London Clay may be seen at Watford Heath, Bushey Heath, Elstree, Ridge, Barnet, Mimms, Hoddesdon, Widford, Thorley, Bishop's Stortford, and other places.

CHAPTER II

THE STUDY OF THE ROCKS: THE GAULT AND THE GREENSAND

THE nature and properties of the Rocks themselves and the fossils they contain must now claim our attention. The beds or formations are taken in the following order, beginning with the lowest :

LONDON CLAY.
Reading Beds.

CHALK.

Upper Greensand.
GAULT.

The **Gault** : this is a stiff blue clay which is readily cut with a spade in the pits or cuttings, and one may see the brick-makers thus cutting it, preparatory to mixing it with sand so as to mould it into the right shape for bricks.

A hand specimen may be cut easily with a knife, and it can also be moulded into different shapes quite readily, especially if the sample has been obtained fresh from a

clay pit, or if it has been moistened with a little water beforehand. It is impervious, or non-porous—that is, it will not allow water to pass through it readily. See the experiments on p. 20.

In examining a fresh cutting of the Gault in a brick-field or other place, it is sometimes difficult to see any well-marked lines such as may often be seen in sands and sandstones, shales and limestones. It is not so clearly marked out into layers or beds as are most of the rocks just mentioned. These layers are known as "beds" or "strata,"[1] and rocks which have been laid down in such layers or beds are said to be "stratified." Though the Gault is really a stratified rock, it does not always show its strata very clearly; they can often be seen only because of slight sandy beds which occur at different levels, and which show that the Gault Clay is, after all, a rock which has been laid down in water one layer after another.

The **Upper Greensand**: the thin band of sandy "rock" at the top of the Gault Clay is very different, both in appearance and properties. It is quite porous—that is, water can soak into it and run through it quite readily. It is usually seen to be made up of layers or strata of slightly different colours. Each stratum or bed can be readily distinguished from those above or below it. Again, the reader should refer to the experiments given on p. 20.

It may be remarked here that the Upper Greensand occupies very little of the ground surface in Hertfordshire, but it can often be seen at the bottom of a chalk pit or quarry.

The Fossils of the Gault and Upper Greensand.

In the Gault Clay, fossils are often quite common. The Gault was formed in an ancient sea into which fine mud

[1] "Stratum" is the singular.

was washed from land not far away; this mud has been compressed and partially dried by natural processes in the course of the long ages since it was laid down, and it is now called **Clay** instead of **Mud.**

In that ancient sea there lived fishes such as sharks, "shell-fishes," sea-urchins, and other creatures; the remains of these living creatures were buried in that ancient mud; the shells, teeth, and bones, like the mud itself, have been much changed in the course of time, but it is perfectly easy to recognise them. Such remains of animals, and of plants also, which are found in the rocks are called **Fossils.** Collecting fossils and learning about them is very interesting.

Some of the commonest fossils in the Gault are sea-shells of a different kind from any that are living to-day. They are coiled shells, with beautiful ornamental patterns, and are called Ammonites by the geologist. These particular fossil-shells are favourite objects of the collector, and very beautiful specimens may sometimes be found in the Gault of northern Hertfordshire. There are fossil sea-shells of other kinds found in the Gault; a few of these and of the Ammonites are shown in Plate I.

Other common fossils in the Gault are sharks' teeth; these also are beautifully preserved. They are not quite the same as the teeth of the sharks which are found in the seas now, but we can recognise what they are without any difficulty. There are very few kinds of plants or animals living to-day which were living when the Gault was laid down as a fine mud in that ancient sea. Almost all the kinds of living things which inhabited the sea and the land then have long since died out.

Now we come again to the **Upper Greensand.** There are sometimes good fossils found in that too, but they are generally slightly different from those found in the Gault. Of course, these Gault and Upper Greensand

fossils can only be found, near the surface, in the northern parts of the county, and girls and boys who live in that part may easily make a good collection of excellent fossils. Ashwell, in the far north-east of Hertfordshire, has long been a favourite collecting-ground.

CHAPTER III

THE STUDY OF THE ROCKS: THE CHALK

The Chalk. We have learnt that the Chalk fills the greater part of the surface of Hertfordshire. Refer again to the map, and note the boundaries of this important formation. It is probable that every boy and girl in the county has seen a chalk-cutting, or quarry, at some time or other; these cuttings are so common in the great four-sided belt in the middle of the county that it is quite easy for any one in mid-Hertfordshire to go and inspect one.

Chalk is a soft, greyish white rock, frequently stained somewhat yellow or brown with oxide of iron. When it is freshly cut it is often nearly pure white, as may be seen in many a quarry or chalk-pit. It varies a good deal in hardness, though it is never so hard as some of the rocks found in many other parts of Britain. Compared with rocks found in Wales and the Pennines, for example, it would be called a soft rock. Some slightly harder layers of the Chalk are well seen in Hertfordshire, and the student should have no difficulty in seeing them and comparing them with the main part of the Chalk formation, which is not so hard. These harder beds are used to divide up

the whole formation into three parts, which are called the Lower Chalk, Middle Chalk, and Upper Chalk.

Near the middle of the Lower Chalk is a flaggy rock, about 20 feet in thickness, called the Totternhoe Stone, because it has been quarried a good deal in the neighbourhood of the Bedfordshire village of that name. It was formerly much used as a building stone. This hard bed of the

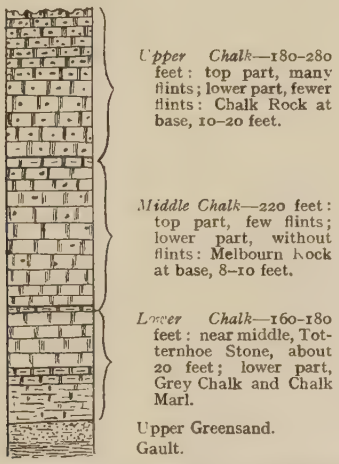

Upper Chalk—180–280 feet: top part, many flints; lower part, fewer flints: Chalk Rock at base, 10–20 feet.
Middle Chalk—220 feet: top part, few flints; lower part, without flints: Melbourn Rock at base, 8–10 feet.
Lower Chalk—160–180 feet: near middle, Totternhoe Stone, about 20 feet; lower part, Grey Chalk and Chalk Marl.
Upper Greensand.
Gault.

FIG. 4.—A Diagram of the Chalk Series of Hertfordshire, with approximate thicknesses of each part.

Lower Chalk may be well seen in Hertfordshire, in the north-west, near the pretty village of Aldbury, and at other places along or near the northern boundary line of the county from Tring to near Ashwell. In the north-east of the county it may be seen especially well in the Royston Downs.

At the base of the Middle Chalk is the Melbourn Rock, named after a village in Cambridgeshire. This is a hard, massive rock, 8 to 10 feet thick, which may also be seen in many places in Hertfordshire.

At the base of the Upper Chalk there is a fairly hard bed, called the Chalk Rock, which can be seen at Berkhampstead, Boxmoor, Apsley, Kensworth, and Baldock.

Generally it is in these harder strata of the Chalk formation that fossils are most easily to be found.

The diagram, Fig. 4, shows the relation of these hard bands to the rest of the Chalk. Note the thickness of the whole formation as shown in Hertfordshire. After the reader has mastered the relation of the various parts, he or she should try to solve a most interesting problem of Hertfordshire. There are some strata in the upper part of the Chalk formation in many parts of Western Europe which are not found at all in our county. First of all, how do geologists know that there are higher beds in other parts of the Chalk of Western Europe? After solving this, try and explain the absence of these uppermost Chalk beds in Hertfordshire.

At this stage in the reading many of the experiments and observations on the Chalk may conveniently be attempted.

In Section II. of this book it is pointed out that the Chalk Downs of the Chilterns are dry uplands where rain quickly soaks into the porous rock. There are exceptions to this dry character of the Chalk country, where the surface is more or less covered with Boulder Clay—a surface deposit which is impervious. It is easy to see why so many of the stream courses of the Chalk country are dry after a long spell of fine weather. In many parts of Hertfordshire the small rivers may be seen starting from springs where the water comes bubbling up from the Chalk. Such water-springs are seen in the following places: Ashwell, Oughton Head, Well Head, Bulbourne, Great Gaddesden, Bourne End, Trowley Bottom. The diagram, Fig. 7, will help to make clear the origin of these springs.

Chalk is largely made up of fragments of sea-shells, sea-urchins, and other sea organisms, and of the very tiny

tests or shells of minute organisms which once lived in the open sea in countless millions. These fell to the bottom of an ancient, deep, clear sea into which very little sand and mud was washed from neighbouring lands, and a mass of greyish white "ooze" was piled up until it was hundreds of feet in thickness. The harder bands or strata which have already been referred to were no doubt formed under somewhat different conditions, probably in shallower water. In any case, Chalk is mainly made up of what the chemist calls calcium carbonate, or carbonate of lime, because the shells of most of the living things just mentioned consist of that substance. In other words, Chalk is a limestone, usually a remarkably pure one, but still a limestone. This means that when it is strongly heated it is changed into lime. In Chalk regions it is therefore a common thing to find limekilns —that is, big chimney-like structures where the Chalk is heated until its nature is completely altered. It is no longer carbonate of lime; it is lime itself, a substance with very different properties. If 100 grammes of pure limestone are roasted in this way until it does not lose any further weight, it is found that 56 grammes of lime are left—that is, 44 parts per 100 by weight have been driven off. The loss is due to the escape of the gas called carbon dioxide or carbonic acid gas. This result may be put in a brief form in this way:

100 grammes of pure chalk } give { 56 grammes of lime. / 44 grammes of carbon dioxide gas.

The greyish white material left in the limekilns is the lime which is so useful in many ways. It is used in the making of cement, plaster, and mortar; farmers put it on the fields to make them "sweeter" and so produce better crops; it is used in tanneries, gasworks, and other chemical works; and it is required in big quantities for softening the

hard water of many districts so as to make it better for drinking and more economical for washing purposes. Carry out as many of the suggested experiments on lime as you can.

Flints in Chalk. In the Upper Chalk more especially there may often be seen bands or layers of pieces of flint ; these are usually black or grey, with a white coating ; they are generally more or less rounded, mostly solid, but sometimes hollow. In some places, instead of these irregular rounded lumps of flint, there is a thin layer which is continuous over a wide area. Fossils are often found enclosed in flints, especially fossil sponges, and the irregular pieces or the layers of flint have probably been formed from the spicules of sponges, which were formerly scattered through the Chalk in great quantities, These minute rods or little spikes of spongy flint have been dissolved in some way that we do not yet understand, and then the flinty matter has been collected together and redeposited round some starting-point, or along some particular layer or stratum, to form the familiar flint masses of the chalk-pits and quarries. There is no difficulty whatever in seeing plenty of examples of flint in Hertfordshire, and you should note the very different forms in which this mineral occurs in the Chalk.

In Hertfordshire flints are very plentiful as a rule in the Upper Chalk, not nearly so common in the Middle Chalk, and very rare or absent in the Lower Chalk. Hence it is frequently the custom to tabulate the Chalk strata of the county as follows :

Upper Chalk .	Chalk with many flints. Chalk Rock.
Middle Chalk .	Chalk with few flints. Melbourn Rock.
Lower Chalk .	Chalk without flints. *Totternhoe Stone.* Chalk Marl at the base.

Fossils of the Chalk.

The Chalk often contains very beautiful fossils, especially in the harder strata which have already been described—the Totternhoe Stone, The Melbourn Rock, and the Chalk Rock. These fossils are frequently perfect in shape and show the original markings very well indeed. Some of the commoner types are sponges, echinoids or sea-urchins, and many varieties of sea-shells. The sponges are usually preserved in a flinty form, and by carefully washing away the Chalk from the flinty fossils they may be obtained almost perfect. The sea-urchins or echinoderms are favourite objects with fossil collectors, and many fine specimens have been obtained in Hertfordshire, and may be seen in the museums at St. Albans and Letchworth. Sea-shells are also obtained, but some of the larger ones are often found broken into fragments. There is one very beautiful kind of shell which often retains its spines in a perfect condition, and this, too, is often found in Hertfordshire.

Any reader who tries to make a collection of fossils must be prepared to exercise a little patience and to meet with disappointment at times. In some chalk-pits, especially in the very soft white Chalk, one may have very little success; sometimes, on the other hand, many good specimens may easily be found. The Chalk Marl, at the bottom of the Lower Chalk, best seen in the northern part of the county, is a favourite collecting ground, and good fossils may often be got from it.

Some of the commonest Chalk fossils are shown on Plate II. Compare those you find with the figured examples, or with those in the museums mentioned. The reader should go to the Natural History Museum at South Kensington and see the very beautiful collections of fossils there; some of these, from the Gault, Greensand, and Chalk of Hertfordshire, are exceedingly fine.

CHAPTER IV

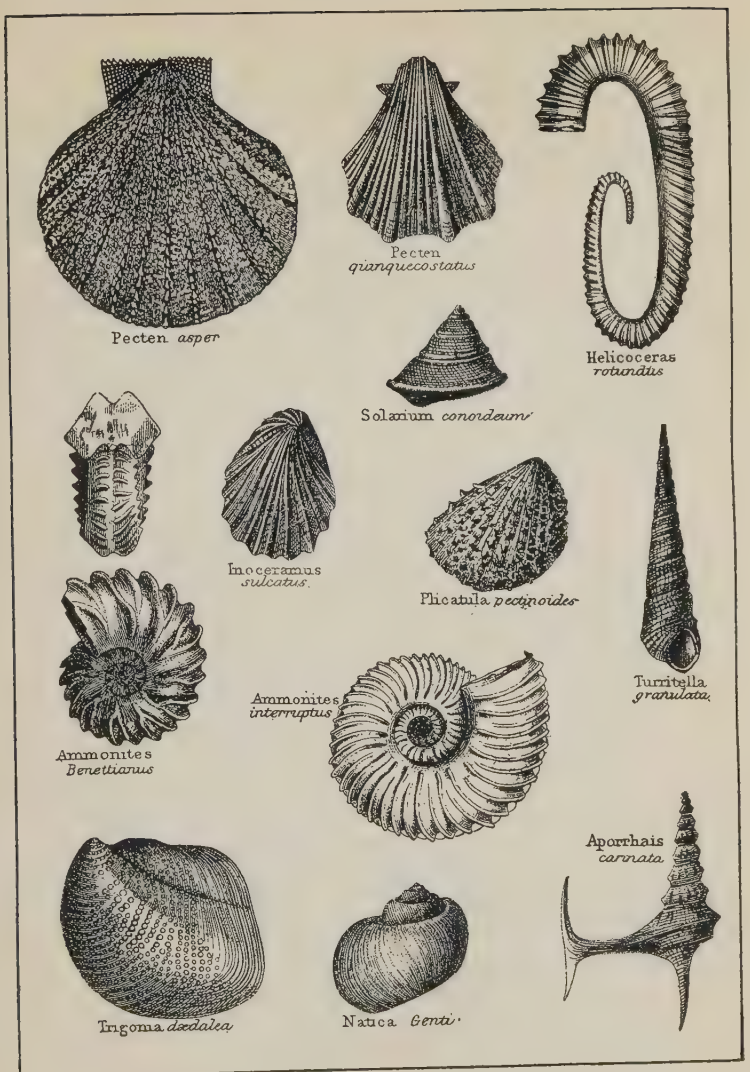
THE STUDY OF THE ROCKS: THE READING BEDS AND LONDON CLAY

In the south of Hertfordshire, as already explained, there are seen lying on the Chalk some "rocks" which are very much younger than the latter; the first and lowest of these are the Reading Beds—so called because they are well seen in the neighbourhood of Reading—and then on top of these comes the London Clay.

The **Reading Beds** consist of mottled clays, sands, and pebble beds resting on an irregular surface of the Chalk. The clays are sometimes used for brick-making; the sands are brown, yellow, and light-coloured deposits. The pebble beds are most interesting in the neighbourhood of Radlett and North Mimms, where the pebbles are cemented together by a hard deposit of a substance called silica, to form the famous rock known as "Hertfordshire Pudding Stone." This is composed of hard, rounded pebbles of flint held together by a cementing substance as hard as the pebbles themselves. Sometimes the rounded pebbles are black on the outside and red or orange in the inside, and so, when the rock is cut and polished, it presents a very beautiful appearance. Excellent polished specimens may be seen in the Museums. This famous "conglomerate" or Pudding Stone is found at Newberries Park, Radlett, and North Mimms, as already mentioned, and also at St. Albans, Bushey, Boxmoor, and Great Gaddesden.

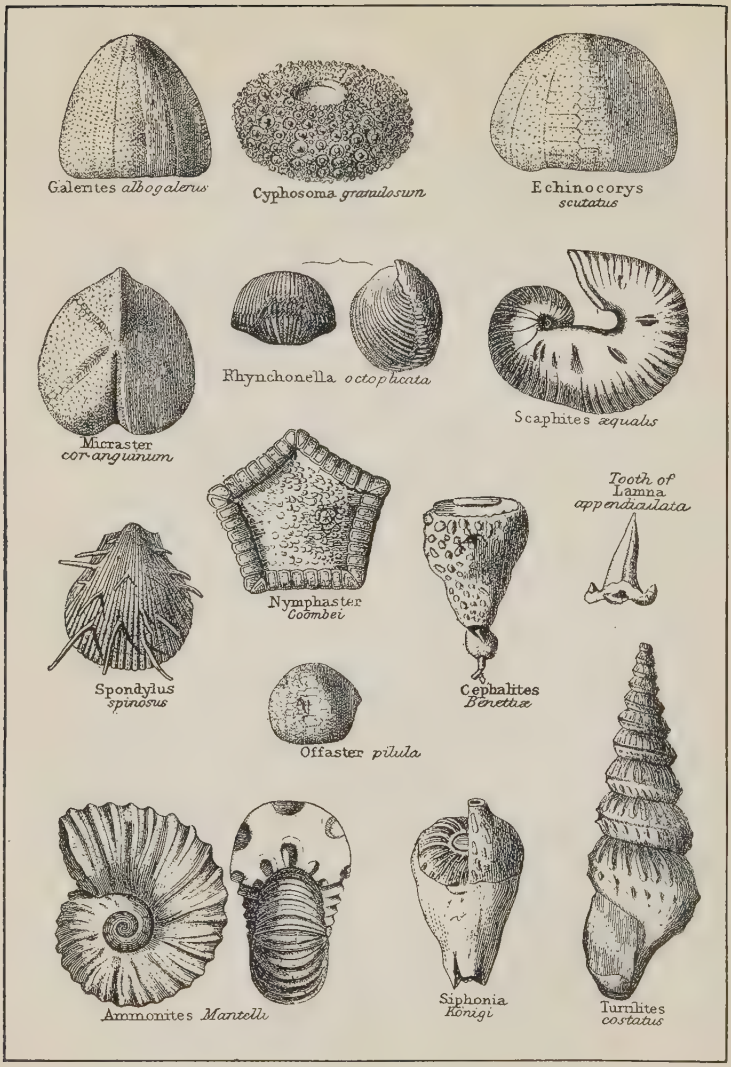
The Fossils of the Reading Beds.

The Reading Beds of Hertfordshire are not rich in fossils, but good specimens are found in some places,



FOSSILS OF THE GAULT AND UPPER GREENSAND.

(By courtesy of Messrs. Edward Stanford Ltd., from Stanford's *Geological Atlas of Great Britain and Ireland.*)



FOSSILS OF THE CHALK.

(By courtesy of Messrs. Edward Stanford Ltd., from Stanford's *Geological Atlas of Great Britain and Ireland.*)

including several kinds of sea-shells, a good many sharks' teeth, bones of a turtle, and occasional teeth of small land animals. The sea-shells are quite unlike those found in the Gault, the Upper Greensand, and the Chalk, not a single species found in any of the three formations named having lived on into the time when the Reading Beds were formed; they had all died out in the long period of time which must have elapsed between the formation of the Chalk and the deposition of the Reading Beds.

The **London Clay** comes on top of the Reading Beds, as already pointed out. Those readers who live in the southern part of the county will have no difficulty in seeing what this well-known "rock" is like, for it is continually being exposed in cuttings of one kind or another. It is a stiff clay, usually dark blue when freshly cut, but turning brownish when exposed to the air for a time. Its properties are broadly the same as those of the Gault Clay. The London Clay is largely used for brick-making in many parts of south Hertfordshire and the neighbouring parts of Middlesex. Hundreds of thousands of houses in London and district are built of bricks made from it.

Fossils of the London Clay.

The London Clay contains excellent fossils in places, especially in the lowest stratum—or basement bed, as it is called—and these may often be found in a good state of preservation. Small sharks' teeth are again plentiful, and with these may be found different kinds of sea-shells, including the shells of a very large oyster. Some of the well-known London Clay fossils are shown on Plate III.

CHAPTER V

THE MORE RECENTLY FORMED ROCKS: "DRIFTS"

The rocks of our county—Gault, Chalk, London Clay—are often found to be overlain by irregular patches of gravel or sand or clay. These patches of covering material are usually called "drift"; this drift was the work of melting ice and of rivers, and was formed in what geologists call the Recent Period—that is, the period in which Man first appeared in Europe and the British Isles.

The chief of these surface deposits found in Hertfordshire are: Clay-with-Flints, Boulder Clay, Plateau Gravel, River-drift, and Lake deposits. The Clay-with-Flints occurs on the surface of the Chalk and has been formed by the gradual and very slow action of rain-water upon the Chalk. The soluble part of the Chalk, amounting to over 90 per cent., has been dissolved in the rain-water and very gradually carried away; the insoluble clay and the flints have been left behind. This surface deposit varies much in thickness, from a few inches to 5 or 6 feet—the latter thickness occurring chiefly in hollows on the surface of the Chalk.

Boulder Clay is an irregular deposit of clay with which a good deal of chalky matter is mingled. As its name indicates, it contains a great many rounded stones or boulders, some of which have come from the north, far outside the county. These were no doubt brought here by the ice-sheets in the Glacial Period or Ice Age, when a good deal of northern Britain was covered by glaciers, and when the British Isles probably presented an appearance much like that of Spitzbergen to-day. There is a

fine deposit of Boulder Clay nearly 20 feet thick at Bricket Wood, between Watford and St. Albans. Similar irregular patches are found in many places, especially in the eastern part of the county.

The Plateau Gravel is frequently found on the higher ground in the county. It occurs at Bernard's Heath, near St. Albans, at a height of 420 feet; but it is not always so high as this, however, for at Bishop's Stortford the student may find it at about 220 feet on both sides of the Stort valley. There is no difficulty in seeing examples, however, especially in the southern part of Hertfordshire, for builders

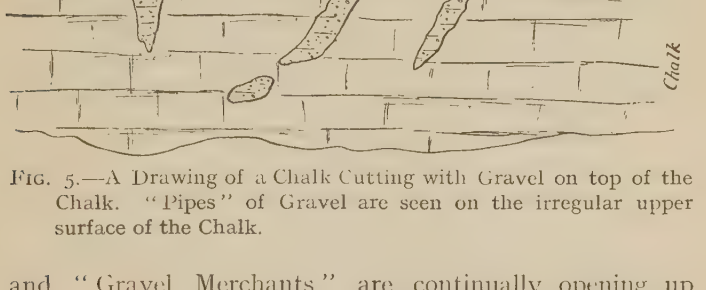


FIG. 5.—A Drawing of a Chalk Cutting with Gravel on top of the Chalk. "Pipes" of Gravel are seen on the irregular upper surface of the Chalk.

and "Gravel Merchants" are continually opening up Gravel Pits in the Plateau Gravels in the neighbourhood of the towns (see Plate VI. *a*, and Fig. 5).

Down in the river valleys, especially in the lower and wider valleys of the Lea, the Colne, and their bigger tributaries, there are deposits of river sand and fine mud, very often mixed with the remains of much decayed vegetation; these deposits of river alluvium may be well seen wherever the rivers change their courses as they swing about in the lowlands. It is quite obvious that these river deposits are still being formed, for in times of flood the "brimming rivers" overflow their banks, and the fine mud and sand

which their waters carry in suspension at flood-times drop to the bottom, and new material is thus added to the deposits in the low land on the banks of the rivers.

The soil of Hertfordshire is largely derived from these irregular "drift" deposits, with the addition of much material from the groundwork rocks below. On the hill-sides and the flatter parts of the hilltops the soil is often of a clayey character, while in the valleys it is generally opener and much more porous, because it has been largely derived from sand and gravel. It will be seen that almost everywhere in the Chalk districts the soil contains a very considerable mixture of flints; these flints help to make the soil—which might otherwise be rather heavy and close—open to air and water, and so more fertile. Chalky soils are well suited for wheat, oats, and barley, especially the latter; this is particularly the case where either Clay-with-Flints or chalky Boulder Clay lies not too thick on the Chalk itself. Where the soil is very thin, as is the case on some of the higher Chalk Downs, a short but sweet and good grass grows which is admirably adapted for sheep-rearing. In the London Clay region in the south of the county the soil is "heavy" and not so well suited for corn crops as for grass; farmers sometimes speak of this part of Hertfordshire as the "Hay Country."

APPENDIX

EXPERIMENTS AND OBSERVATIONS TO BE DONE AS OPPORTUNITY OCCURS

EXPERIMENT 1.—Take a piece of Gault Clay or London Clay as fresh from a cutting as possible. See that it is free from stones and sand. Keep it moist. Mould it into the shape of a basin. Pour water into the basin until it is full. Notice what happens, and explain.

EXPERIMENT 2.—Trim a piece of chalk about as big as your fist into the shape of a small brick. Cut out a basin-shaped hollow in the upper surface (see diagram below).



FIG. 6.—A piece of Chalk, fairly neatly trimmed, and with a basin scooped out in the middle of the top face as indicated by the dotted line.

Pour water into this hollow as you did in Experiment 1. Notice what happens, and explain. Do the clay and the chalk behave alike ?

EXPERIMENT 3.—Trim a piece of chalk into the shape of a block about 3 inches in depth, width, and length.

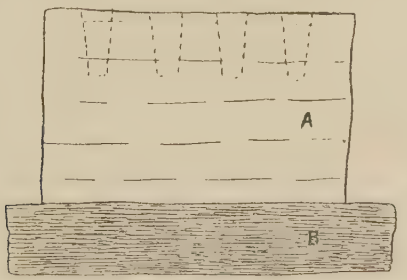


FIG. 7.—*A*, A piece of Chalk, trimmed fairly neatly, and with a number of holes in the upper surface as shown. *B*, A flat piece of Clay with a smooth upper surface, on which the piece of Chalk, *A*, rests evenly.

Bore a few holes about an inch deep in the upper surface of the block. Stand it on a base of Gault Clay or London Clay, taking care that the chalk fits neatly on the clay surface (see the diagram above).

Now pour water carefully into the holes on the upper surface of the chalk until no more will sink in. Notice where it comes out, and explain what has happened.

EXPERIMENT 4.—Place a piece of chalk in a bright red fire, and allow it to become quite "red hot." Leave it in the fire for some hours. When the fire has gone out and all is cool, take out the chalk and examine it. Has it altered in appearance in any way? Carefully pour water on the baked chalk and note what happens. Place a little of the baked chalk in a glass of water, stir well, and allow to settle. Now taste the water (you may safely do so). Is the water any different now? What do you suppose the chalk has become by being baked in the red-hot fire? Get some quicklime from a builder and try experiments to find out how it differs from chalk which has not been "burnt" or roasted.

EXPERIMENT 5.—Take some clear "lime water" from the last experiment, or buy some from the chemist. Bubble air from your mouth through it, using a straw tube. Note carefully what happens. Discuss with other pupils and with your teacher.

EXPERIMENT 6.—Take two pieces of Gault Clay or London Clay about as big as your fist. Mould them into the shape of a small brick. Put them both in a dry place for about a day. Now take one piece and place it in a bright red fire and allow it to remain for a few hours. After the fire has gone out, and when all is cold, take the baked clay and compare it with the unbaked piece. Test both pieces by moistening with water and seeing if you can mould them into different shapes. Write down in two columns the different properties of the baked and the unbaked pieces. Discuss with your fellow-pupils or your teacher.

EXPERIMENT 7.—Take a piece of chalk and a piece of flint. Try to scratch each with a knife. Do you find any difference? Which is the harder, chalk or flint?

EXPERIMENT 8.—Break a small lump of chalk into pieces about as big as peas, and place a few of these bits in a beaker or drinking-glass. Cover with about half an inch of water. Buy some hydrochloric acid (spirit

of salts) from the chemist. (Two fluid ounces is enough.) Remember that the acid is poisonous and that it must not be left about carelessly; also take great care that none of it comes in contact with your clothes or the tablecloth or carpet. Pour a little of the acid on the chalk and water in the glass very carefully. Note what happens. Can you explain? While the action is taking place hold a lighted match in the beaker or glass above the water and acid; again note carefully what takes place.

EXPERIMENT 9.—Try Experiments 4 and 8 with pieces of flint. Do you get the same results as with chalk?

EXPERIMENT 10.—Obtain a piece of "Hertfordshire Pudding Stone" if you can. Describe its appearance. What are the pebbles in it made of? What is the cement like that binds the pebbles together? Try Experiments 4, 7, and 8 with some pieces of it. Is it more like flint or like chalk in its behaviour?

EXPERIMENT 11.—Get three glasses of water and place them side by side. Into the first place a little fine sand, into the second a little finely powdered chalk, and into the third a little very finely powdered clay. Stir all three equally and leave them to stand. Compare the results in the three cases, and see which becomes clear most quickly and which most slowly.

EXPERIMENT 12.—Try Experiment 11, using powdered air-dried clay for one glass and powdered baked clay in the other. Again compare results.

OBSERVATIONS TO BE MADE OUTDOORS

(*a*) What "rocks" do you see in the cuttings or pits in your district? Write a careful account of any cutting or pit in your district; ask your fellow-pupils or your teacher to read it and see if they agree with your description. Make a drawing.

(*b*) Collect specimens of different kinds of flint pebbles. How many different colours can you find? Are the flint pebbles in the natural cuttings rounded, or are they broken and angular?

(*c*) Visit a chalk cutting or a number of such "exposures." Do you find some parts of the chalk harder than others? Does the chalk appear different in wet weather from dry weather?

(*d*) If there are cuttings of sand, gravel, clay, or chalk near your home, find out what use is being made of the materials obtained.

(*e*) Get a bottle full of water from the nearest river after a thunderstorm or continued heavy rain—that is, when the river is in flood. Allow it to stand for a day or two. What becomes of the material which is being carried down by the river? Also get some perfectly clear river water when the river is not in flood. Fill a saucer with it and allow it to stand for some days, taking care that no dust or smoke can fall into it. When the clear water has dried up or evaporated is anything left? What do you learn from these experiments?

(*f*) When you have opportunity visit different parts of the county. Try to see places where water springs up out of the chalk. Also try to find places where it disappears into the chalk. When you travel you will be able to see similar things in other regions, both in chalk and other rocks, and it will help you if you have seen these things near home.

(*g*) You have learnt that chalk is porous. (What does that mean?) You also know that much of the upland country in Hertfordshire has a basis of chalk. How do you account for the fact that swampy places and shallow ponds are not uncommon on the chalk uplands? Write a description of one or more such cases.

(*h*) Visit gravel pits or chalk quarries and notice carefully how deep is the soil. See if there are bits of chalk in the soil above a chalk cutting, and what sort of pebbles there are in the soil above a gravel pit.

(*i*) Make a collection of your own of fossils from different parts of the county as you have opportunity. With the help of other pupils try to get together a school collection. Always make a very careful record of the exact places from which your specimens were obtained.

(*j*) Visit the museums in Hertfordshire and go to the Natural History Museum at South Kensington and see the beautiful specimens which have been obtained from the various rocks of Hertfordshire.

(*k*) Find out what lime is used for in your district. If possible, find out where it has come from, and whether it has been brought by rail or road or canal.

Section II.—PHYSICAL GEOGRAPHY

By ALBERT N. WILMORE, Diploma in Geography, University of London

CHAPTER VI

GENERAL POSITION, SIZE, AND BOUNDARIES

The county of Hertford is one of the inland counties of England, having no seacoast; it is one of the Home Counties which lie round about the great metropolis, London. Being a short distance north and north-west of London, it is one of the group often referred to as the South-Eastern Counties, whilst a journey northward or north-westward through Hertfordshire soon brings the traveller into that other group called the Midland Counties.

Our county is surrounded by five others, having Essex to the east, Cambridgeshire and Bedfordshire to the north, Buckinghamshire to the west, and Middlesex to the south. With an area of, roughly, 630 square miles, Hertfordshire is one of the medium-sized counties, being larger than Bedfordshire and Cambridgeshire but much smaller than our largest ones, such as Yorkshire, Lincolnshire, Devonshire, and Norfolk. It is necessary that these relationships of Hertfordshire to other counties in size and position should be understood, although we are more concerned here with the Physical Geography of the county—its hills and valleys, its open commons and its marshy lowlands, and the relationship of the rivers to these natural features.

Before passing to the study of the natural features, it may be well to take a very brief glimpse at the way in which Hertfordshire came into existence as a separate county. When the Romans left Britain in the fifth century, leaving behind their traces such as roads, camps, and villas, of which there are many in Hertfordshire, notably the remains of the important city of Verulamium (or Verulam) near St. Albans, the country was at the mercy of invading tribes from the mainland of Europe. The Angles, Saxons, and Jutes landed on the east and south, and spread inland, establishing their kingdoms, the names of some of which still remain with us as county names; two of the counties bounding on Hertfordshire—Essex and Middlesex—remind us by their names that they were once the regions of the East Saxons and the Middle Saxons respectively. At this time it seems probable that what is now Hertfordshire belonged partly to Essex, but more to the greater kingdom of Middle England, Mercia, in which Berkhampstead was an important place. After the coming of the Danes at a later period, the larger kingdoms were divided into **Shires**, each shire consisting of a piece of land surrounding a fort or forts built to keep the Danes under control. Many of these forts which ruled shires were situated at points where rivers could be readily forded—that is, where roads crossed rivers. We thus find some county names of England ending in "-ford," and it seems most probable that our county became the shire of Hertford, and although other meanings have been given to this name the most probable one seems to be the Anglo-Saxon **heort's ford** or hart's ford.

It must not be assumed, of course, that the Hertfordshire thus created has remained exactly the same in area or in boundaries through the centuries; there have been many changes, most of them minor ones, some of which may be studied on old maps of the county.

We have already seen that five other counties surround Hertfordshire, and some notice must be taken of what actually constitutes the dividing-line or boundary at various points. When any land is to be cut up or divided into smaller areas, whether it be kingdoms or the smaller shires or whether it be the smaller areas of townships or parishes, one can readily understand that certain natural features may play an important part. A good example of this may be seen on a Political map of England, noticing how the river Thames forms the boundary throughout a great deal of its course between the counties lying to the north and to the south. Almost every reader will doubtless be able to find similar cases of township or parish boundaries, or of streams or other small features which mark off farm from farm or estate from estate in his or her own home locality.

In the case of the county of Hertford this is not a very simple matter, for the boundary is very irregular, and over no very long continuous stretch does any particular natural feature form the dividing-line. The Physical map (*back cover*) shows small examples of this use of natural features; for instance, in the south-west from near Mill End to near Harefield, for some 2 miles, the river Colne separates Hertfordshire from the county of Middlesex, and after crossing the higher ground between the valleys of the Colne and the Misbourn the boundary follows the river Chess from Sarratt Bottom to Latimer. Again crossing the high ground between the valleys of the Chess and the Bulbourne, the county boundary then follows for a short distance the usually dry course of the Bourne, near Bourne End.

It is interesting to note in passing that, for some considerable distance along this western boundary, Hertfordshire is separated from that part of the county of Buckingham known as "The Chiltern Hundreds," the urvival of a group of three of the old "hundreds" or subdivisions of shires.

Beyond Tring in the north-west, where a lobe of Hertfordshire juts out into and is nearly surrounded by Buckinghamshire, the county boundary in the neighbourhood of Long Marston follows the courses of small streams. Along practically the whole of the northern boundary the dividing-line runs irregularly along the high ground of the Chilterns until, north of Hitchin, the river Hiz is followed for a distance of nearly 2 miles. Then in the north-eastern lobe of the county which takes in Baldock and Ashwell, the rivers Rhee and Cam provide examples of natural boundaries.

There are no very striking examples of such natural dividing-lines on the eastern side until, from near Bishop's Stortford to Waltham Abbey with minor deviations, the rivers Lea and Stort form the boundary between Hertfordshire and Essex. The southern boundary from Waltham Abbey to near Rickmansworth is almost entirely what may be called an "artificial" one, running irregularly across the higher ground, with the exception where Hertfordshire pushes a southward lobe into Middlesex at Chipping Barnet, and the tributaries of the river Brent in the neighbourhood of Totteridge form the boundary between the two counties just mentioned.

With this brief account of the origin of our shire or county division and of some of its relationships to surrounding shires or counties, we pass to the more detailed study of the different surface features.

EXERCISES ON CHAPTER VI

1. Which others, besides Hertfordshire, are called Home Counties?
2. What other "Roman Remains" do you know, and have you any in your own locality?
3. Where did the Angles, Saxons, and Jutes come from?

4. Which English counties remind us by their names of early English kingdoms or divisions ?
5. What county names do you know ending with " -ford " ?
6. Can you find any examples of boundaries following natural or other well-marked features in your own locality ?
7. What use is made at the present day of the post of " Steward of the Chiltern Hundreds " ?
8. Give possible reasons for the present county boundary leaving the rivers for short distances in the low-lying valleys.

CHAPTER VII

UPLANDS AND LOWLANDS

The Upland Belt of the Chilterns.

A Physical or Orographical map of England shows us a band or ridge of uplands running through a considerable part of our county ; these are the well-known Chiltern Hills, which occupy much of northern Hertfordshire, and to which the county owes no small part of its beautiful scenery, including many of its glorious open commons.

In the last chapter we saw that much of the northern boundary of the county runs irregularly along Hertfordshire's main belt of upland, and a good deal can be learnt concerning this upland area by taking an imaginary (or real) journey along the county boundary. Beginning on the west, where the dividing-line between the counties of Hertford and Buckingham leaves the course of the Bourne near Ashley Green (Bucks.) at a height of about 400 feet above sea-level, there is a very steady and gentle climb of just over 400 feet to the main crest of the Chilterns near Hastoe, about 5 miles away, an average gradient of about 1 in 66. From this point the boundary, instead of follow-

ing the line of the Chilterns towards the north-east, continues its north-westerly direction, and, with Tring to the east, drops down to the 400-feet contour not far from Wilstone Reservoir. This drop of 400 feet is accomplished in about 2 miles, an average gradient of approximately 1 in 26. This crossing of the Chilterns from south-east to north-west, with a comparatively gentle rise to the highest parts, followed by a much steeper descent on to the plain beyond, is typical of the whole range of hills, with, of course, many local variations, some of which will be noticed later.

The reader should, at this point, make quite sure that

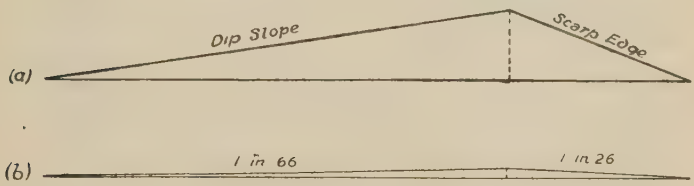


FIG. 8.—Comparison of the gradients of the Dip-slope and the Scarp-edge of the Chilterns: (*a*) with vertical heights magnified ten times, (*b*) true to scale.

the geological explanation of the gentle dip-slope and of the steeper scarp slope or edge given in Chapter I. is thoroughly understood.

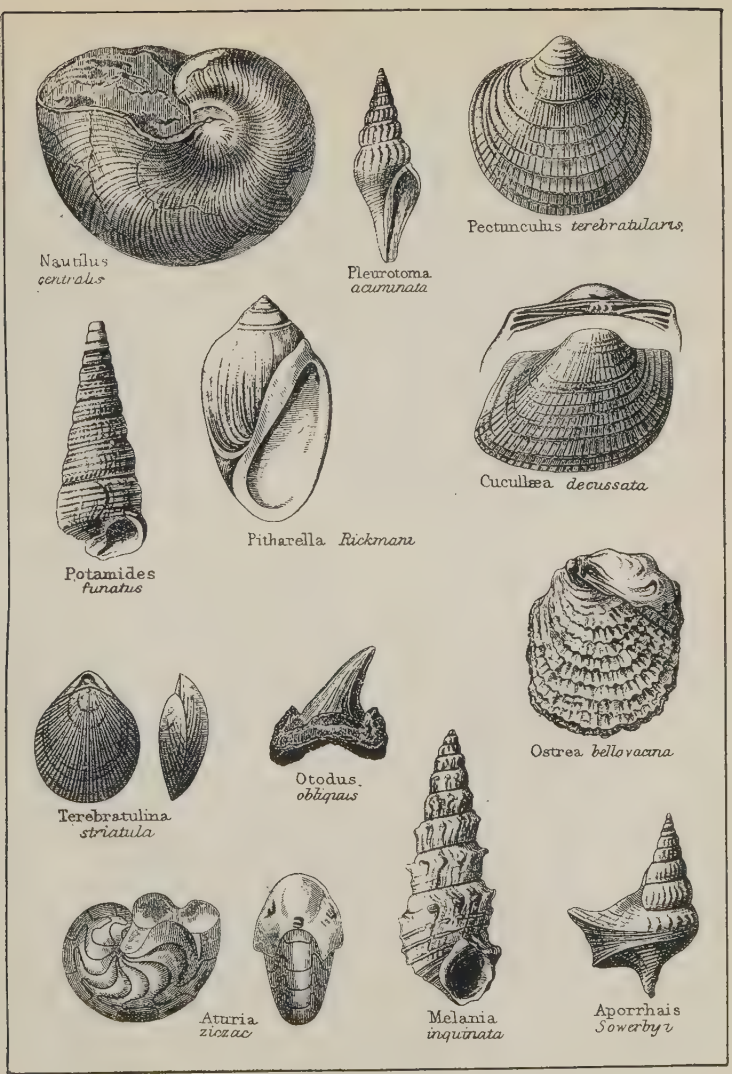
If we return to the boundary where it passes its highest point, near Hastoe, or to the neighbourhood of Wigginton, and look north-eastward along the general line of the Chilterns we readily see that even had the boundary taken this direct line, there would have been a fairly rapid drop to a height of somewhere near 400 feet a little south-east of Tring Station, followed by a corresponding climb up to heights of over 700 feet on Moneybury Hill and Pitstone and Aldbury Commons, where the actual boundary is again found. There is thus a break in the Chilterns, and we have

the well-known and important Tring Gap, and the lobe of Hertfordshire, which here juts out into the county of Buckingham, may well be regarded as an "overflowing" of Hertfordshire through the gap, with the result that we find Long Marston, Puttenham, Wilstone, the four great reservoirs, and even Tring itself included in the county of Hertford, although they might seem to be much more naturally related to the surrounding "plain" country which is in Buckinghamshire.

Continuing the journey north-eastward from above the beautiful village of Aldbury, we find that the highest points of the Chilterns are not in Hertfordshire, the boundary running roughly parallel to the general trend of the upland belt but some considerable distance down the dip-slope; thus Ivinghoe Beacon (762 feet) and Clipper Down (811 feet) lie in Buckinghamshire to the north-west, whilst with a general and gentle slope to the south-east in Hertfordshire are the beautiful Ashridge Park, and the great stretches of common above Berkhampstead and Northchurch (see Plate IV, *a*).

Then comes another break in the continuity of the upland belt, similar to that of the Tring Gap, but on a smaller scale; this may well be called the Gade Gap, and in it we find Great Gaddesden and the common of Little Gaddesden, whilst at a point on the road through this gap, a little less than a mile south of Dagnall (Bucks.), three counties meet and Hertfordshire is now separated from the county of Bedford. Here again our county occupies the lower dip-slopes between Great Gaddesden and Flamstead, leaving the higher scarp edges with such heights as Mount Pleasant (over 750 feet) and the Dunstable Downs (nearly 800 feet) in Bedfordshire.

The more general evenness of the uplands is once more broken by a small gap which may be called the Ver Gap, or, as it is perhaps better known, the Dunstable-St.



FOSSILS OF THE LONDON CLAY AND READING BEDS.

(By courtesy of Messrs. Edward Stanford Ltd., from Stanford's *Geological Atlas of Great Britain and Ireland.*)



(*a*) The Common above Berkhampstead.
[*Photo by W. H. Smith & Co., Kingsway Series*



(*b*) River Gade entering the Canal, below the Locks near Grove Mill, Walford.
[*Photo by A. N. Wilmore.*

Albans Gap. It is interesting to note that the journey along the upland belt here brings us to the famous Watling Street at a point in the gap a short distance north of Markyate Street.

Crossing the higher ground east of the Ver Gap the county boundary makes a very marked change from the general north-easterly direction, very similar to that noted near the Tring Gap ; another greater break in the upland is here encountered, the Lea or Luton Gap, and again there seems to have been an " overflowing " of one county into the other, but this time in the opposite direction, for Bedfordshire pushes a lobe into Hertfordshire and our boundary swings south-eastward to cross the river Lea at East Hyde, a little over a mile north of Harpenden.

And now in our journey north-eastward along the upland belt we find the average height of the Chilterns becoming much less, the dip-slopes to the south-east more gentle, and the scarp edges to the north-west less steep. The county boundary from the river Lea turns almost due north and actually goes right on to the Gault Plain (or Bedfordshire Plain) near Hexton, from where it runs with a very general north-easterly direction to Royston, there to turn southward and cross the diminishing upland belt in the neighbourhood of Nuthampstead. These lower hills continue beyond our county, passing into the East Anglian Heights of the counties of Cambridge, Norfolk, Suffolk, and Essex.

From the Luton or Lea Gap, then, we have the whole of the upland belt in our county, with Offley, the two Waldens, and Knebworth on the gentle dip-slopes before we reach the next gap, that of the rivers Purwell and Hiz and the river Beane, or the Stevenage-Hitchin gap, as it may well be called. The towns of Hitchin, Letchworth, Baldock, and Royston stand ranged along the scarp

edge to the north, and on the gentle dip-slopes of these lower Chilterns are Rushden, Buckland, Buntingford, Barkway, and Nuthampstead among many other places, until we pass south-eastward on to the lowland belt.

Hertfordshire owes a great part of its beauty to this upland belt running its entire length—the gently rounded hills of the extreme north and, on the dip-slopes, the great stretches of beautiful parkland and invigorating common. Examples of these commons are found near King's Langley, Chipperfield, Sarratt, and Bovingdon ; and bracing walks are to be had on Shothanger (or Sheethanger) Common, round about Wigginton, Hastoe, Champneys, and Tring Park, and in the delightful stretches from Ashridge Park and Markyate Street in the north by the Gaddesdens, Hemel Hempstead, Redbourn, and Harpenden, to so far south as Bedmond and Abbot's Langley. This beautiful belt runs across the county, by Offley and the two Waldens to the well-wooded stretches about Welwyn, Knebworth, and Stevenage, right into the north-eastern corner of the county, circled around by Hitchin, Letchworth, Baldock, and Royston, and by Nuthampstead, Buntingford, and Aston, in which area it would be almost presumptuous to single out particular places. Almost the whole of the district shows the typical features of the gentle dip-slopes of the Chalk, a belt of scenic beauty of which Hertfordshire has every right to be proud.

The Lowland Belt.

In Chapter I. mention was made of a " valley " running through the county from south-west to north-east, from Rickmansworth to beyond Ware, and it was there explained (p. 6) how one soon passed from the Chalk dip-slopes of the north on to a great belt of clay—the London Clay. We must now look more closely at this lowland belt, although we shall understand it better when

we deal with the rivers of the county in the next chapter. It is important, first of all, to notice that this main lowland belt is really divided into two distinct parts ; a very minor ridge can be traced between St. Albans and Hatfield, running from the neighbourhood of North Mimms to near Sandridge, where it may be said to merge with the dip-slope coming down from the north-west. There are thus two parts of the lowland belt ; in the south-west from Mill End and Rickmansworth by the wide valley at Watford, between Aldenham and Bricket Wood, to the low-lying ground between St. Albans and London Colney ; crossing the low ridge between North Mimms and Sandridge, say at Roe Green, near the main road from St. Albans to Hatfield, we are soon in the north-eastern half of the main lowland belt, the low-lying ground from Hatfield through Hertford to beyond Ware. Much of this belt is occupied by the low-lying alluvial flats in which the greater Hertfordshire rivers flow, and before passing to the study of the last " physical division " of our county, it is important to note that the lowland belt from Hertford and Ware and from Bishop's Stortford and Sawbridgeworth is continued not north-eastward as with the upland belt, but in a southerly direction by Hoddesdon and Waltham Abbey, and so forward to the Thames Valley, with the county boundary following the rivers Stort and Lea.

The Minor Upland Belt of South Hertfordshire.

In the section dealing with the Geology (see Fig. 3) the ascent on to a low ridge to the south of the county was pointed out. From near Moor Park, south-east of Rickmansworth, proceeding once more in a general north-easterly direction, heights of 400 feet and over are again encountered, and by way of Clay Hill and Bushey Heath, through Elstree to Chipping Barnet the ridge runs, widening considerably north and south of the latter place to

Totteridge and through Shenley and Ridge to near North Mimms. Along this part of the minor upland belt the county boundary runs irregularly (see p. 29), but proceeding farther to the north-east by Little Berkhampstead or Cuffley to Hoddesdon, the ridge is entirely in Hertfordshire. Thence, after the break of the lowland belt in the neighbourhood of Ware or Sawbridgeworth, the slightly elevated ground to Bishop's Stortford may well be regarded as continuing the trend of this minor upland belt.

Characterised by very gently rounded hills, often with wide-spreading flat tops, this Clay Ridge, as was mentioned in Chapter V., is known as the " Hay Country," and, though it may not show the scenic beauty of the Chalk slopes of the Chilterns, many are the beautiful rural scenes and delightful stretches of well-wooded " parkland " to be met with in one's country walks.

EXERCISES ON CHAPTER VII

1. What contour line passes nearest your own home or school ?
2. What do you understand by the terms " dip-slope " and " scarp edge " ?
3. Of what use are the four great reservoirs near Tring ?
4. If your home or school is in Hertfordshire, in which " Physical Division " does it lie ?
5. Find some actual differences in height above sea-level of a number of places on the Chilterns, in the lowland belt, and on the southern ridge.
6. Do you know any roads, besides the one shown in Fig. 3, which climb over the southern ridge ?
7. What do you understand by " parkland," and have you any examples in your own locality ?
8. Try and find the average gradient of any road or railway, which is not level, in your own locality.

CHAPTER VIII

THE RIVERS OF HERTFORDSHIRE

HAVING obtained a general idea of the "lie of the land" in the county, we may now proceed to a detailed study of the rivers, and continual reference should be made to the Physical map. Obviously the drainage of the water on the surface of the land must depend upon the slopes of that surface, and from Chapter VII. it is clear that, in Hertfordshire, the two upland belts must be the chief factors in determining the courses of the rivers. We shall notice later how the rivers may in their turn cause considerable changes in the land surface.

The greater belt of upland, the Chilterns, is of prime importance, and when we think of the wide general slope to the south-east and the sharper scarp edge to the north-west, we naturally expect to find the rivers draining in these two directions. To a certain extent this is the case, and the Chilterns form our first watershed, or "divide," as it is sometimes called. Beginning in the extreme north-western corner of the county, where Hertfordshire pushes its lobe into Buckinghamshire, there are several small streams draining generally north-west, as in the neighbourhood of Puttenham and Long Marston, to unite in Thistle Brook along which the county boundary runs (see p. 29). The reader is advised to trace the way in which this drainage goes by the river Thame south-westward through the Vale of Aylesbury to join the river Thames. This famous river breaks through the line of the Chilterns into the Lower Thames Valley or London Basin, in which, as will be seen later, this north-westerly drainage of Hert-

fordshire eventually unites with much of the drainage which flows down the south-easterly dip-slopes.

Passing north-eastward along the Chilterns the main scarp edges lie outside the county boundary for some distance, that is to say, the water divide lies to the north-west of our area, so that we are concerned only with those streams which flow south-eastward down the dip-slopes. When we pass the Luton or Lea Gap, however, we have seen that the whole of the upland belt lies in our county; we thus have both the northward drainage from the scarp edge and that southward down the dip-slopes; in other words, the main divide of the Chilterns lies within our county. Hitchin, Letchworth, and Baldock have been mentioned as standing close to the scarp edge, and here we must notice a few northward draining streams; the river Hiz rises at Well Head, about a mile south of Hitchin, and the river Purwell (sometimes called Pirre) near Ippollitts, and after uniting just north of Hitchin they flow northward (as the river Hiz), forming the county boundary for some 2 miles, after which the Hiz flows northward through Bedfordshire. The region of Letchworth also sends its drainage northward, very soon to leave the county and unite with the Hiz in Bedfordshire, whilst near Baldock the river Ivel rises and soon joins with the Hiz, and so flows into the Great Ouse system. Lastly, near Ashwell, is the river Rhee, which unites with the young Cam, and so flows into the Great Ouse, like the rest of the rivers of north-eastern Hertfordshire.

We must now consider what are, after all, the more important rivers of Hertfordshire—that is, the series of rivers which drain south-eastward down the dip-slope. It is clear from the last chapter that all these rivers must eventually flow to that lowland belt which runs across the county, and, remembering that this belt consists of two parts divided by a low ridge, it will be seen that these dip-

slope streams fall into two groups. In the first or western group are the rivers Chess, Bulbourne, Gade, and Ver,

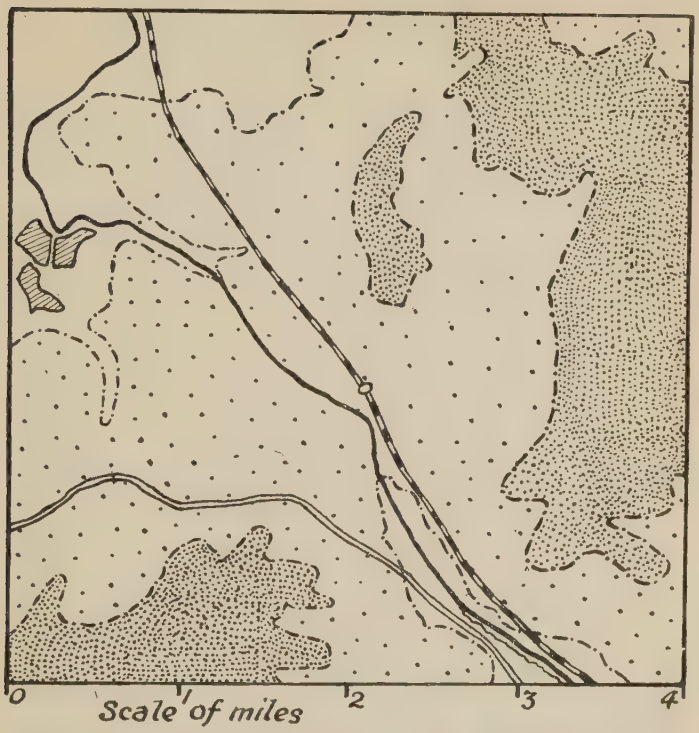


FIG. 9.—Diagram Map of the Tring Gap: land above 600 feet closely dotted, land below 400 feet left blank.

400-feet and 600-feet contour lines — · — · — —
Canal ——————— and reservoirs /////
Railway Tring Station
Main road

whilst in the second or eastern group are the rivers Lea, Maran (or Mimram), Beane, Rib, Ash, and Stort. It may seem strange, at a first glance, that one of the most

important rivers of Hertfordshire—the river Colne—has not yet been mentioned; the reason for this will appear in our study of the first or western group of dip-slope rivers.

Beginning again in the west of the county, the river Chess drains down the chalk dip-slopes of the Chilterns, first of all through "The Chiltern Hundreds" of Buckinghamshire, passing Chesham (Bucks.), to become the boundary between the two counties near Latimer. Here it takes a more easterly course to near Sarratt Bottom, where it again flows in the south-easterly direction past Chorley Wood and Loudwater, to join the river Colne in the wide "flats" a little east of Rickmansworth.

The next of the dip-slope streams, the river Bulbourne, is entirely within our county, and we must look again at the Tring Gap. We can pass through that gap at little more than 400 feet above sea-level, the 400-feet contours crossing the line of the canal at points about 1 mile south and about 2 miles north of Tring Station (see Fig. 9). It is sometimes said that this gap has no river, but if one stands on the canal bridge near Tring Station the water in the canal may be seen to flow distinctly southward, and it is probable that the canal now occupies what was the course of the very young Bulbourne, just in the same way, as we shall see later, that both the rivers Bulbourne and Gade are now represented in many stretches by the course of the canal. The watershed, or "divide," in this part of the Tring Gap is not well marked, and it is not easy to draw a line between the waters which drain north-westward and those which drain, by the Bulbourne, down the south-eastern dip-slopes, but it must obviously be somewhere between the two 400-feet altitudes on the line of the canal. It is to the action of this river Bulbourne in cutting down through the chalk that we must look for the explanation of the gap through the Chilterns which

has proved of such great importance in road, canal, and railway building.

Bearing in mind that the course of the river has been used to a very great extent for the canal, we may trace the Bulbourne by Northchurch to Berkhampstead and Bourne End, following a general south-eastward direction. At Bourne End, opening out into the wide valley of the Bulbourne, may be seen what is usually a dry valley—the Bourne Gutter. In Chapter III. it was shown how porous the chalk of these "uplands" is, with the result that the rains falling on the upper slopes soak downwards to well out as springs at lower levels; the Bourne is a good example of this, for it has been found, by long observation, to flow at intervals ranging up to seven years, and even then the "source" is not constant, being sometimes well up the valley and at others much lower down.

The Bulbourne flows past Boxmoor and receives the next of the dip-slope rivers—the Gade—at the appropriately named Two Waters. The river Gade has its real source some 2 miles north of Great Gaddesden, past which it flows, again in the usual south-easterly direction, and near Great Gaddesden may be seen more springs coming out from the Chalk; it continues by Piccott's End and Hemel Hempstead to Two Waters. From the latter place the combined river (now known as the Gade) flows more directly southward, but still with something of the usual south-easterly direction, past Apsley and Nash Mills, King's Langley, and Hunton Bridge, by Grove Mill and through Cassiobury Park, where it is often indistinguishable from the canal. The river leaves the canal above many of the locks to enter it again below the locks, as may be seen over and over again (see Plate IV., *b*). Leaving Cassiobury Park the Gade turns south-westward over wide "flats" to enter the river Colne almost due south of Croxley Green.

The fourth and last of the western group of dip-slope

streams is the river Ver which rises in the neighbourhood of Markyate Street ; going south-eastward near Flamstead to Redbourn it receives another of those intermittent streams similar to the Bourne at Bourne End ; from Redbourn the Ver still flows south-eastward, and crossing the main road halfway between the latter place and St. Albans soon flows near the site of the old Roman city of Verulamium and by the old Sopwell Nunnery, leaving St. Albans with its Abbey standing on the higher ground to the north-east. The Ver now loses its south-eastward direction and meanders south and south-westward by Park Street and Frogmore over the " flats " of the lowland belt, eventually joining the river Colne a little over half a mile from Bricket Wood Station.

Having traced the courses of these four dip-slope streams, the rivers Chess, Bulbourne, Gade, and Ver, something remains to be said of the river Colne itself into which we have seen them all enter. Broadly speaking, we may describe the Colne as running the length of the lowland belt from the low ridge between North Mimms and Sandridge (see p. 35) until it leaves the county near Harefield, collecting on its way the streams which drain south-eastward from the Chalk dip-slopes of this half of the county. Here we must note that the small ridge, which divides the lowland belt into western and eastern halves, is a watershed or " divide " of some considerable importance in spite of its somewhat insignificant appearance ; for it separates the drainage of the river Colne, and with it the western group of dip-slope streams from that of the eastern group of dip-slope streams which we still have to study.

The river Colne collects a number of small streams from this slightly elevated ground in the neighbourhood of Mimms and Colney Heath ; these streams often disappear by " swallow-holes " into the Chalk, to appear again at lower levels. The river thus made up flows south-west-

ward by London Colney, meandering over the alluvial flats of the lowland belt, near Napsbury and Parksbury,

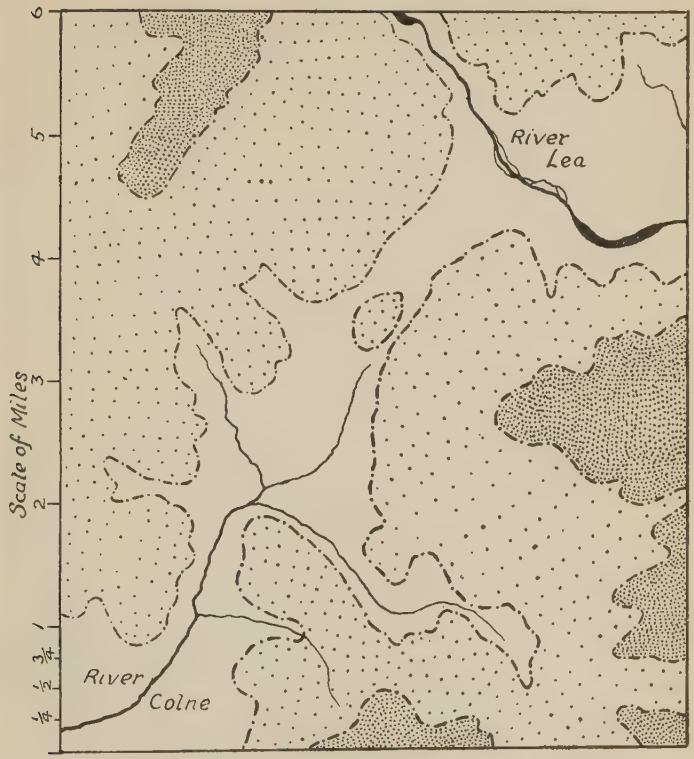


FIG. 10.—Diagram Map of the "Divide" between the valleys of the Rivers Colne and Lea, between St. Albans and Hatfield.

250 and 350-feet contour lines —·—·—·—
Land above 350 feet closely dotted.
Valleys below 250 feet left blank.

and receiving a few minor streams from the clay ridge to the south. It is interesting to note that near Colney Street the rivers Ver and Colne approach within less than

a quarter of a mile of each other, but for at least a mile they both meander, often almost meeting, until they

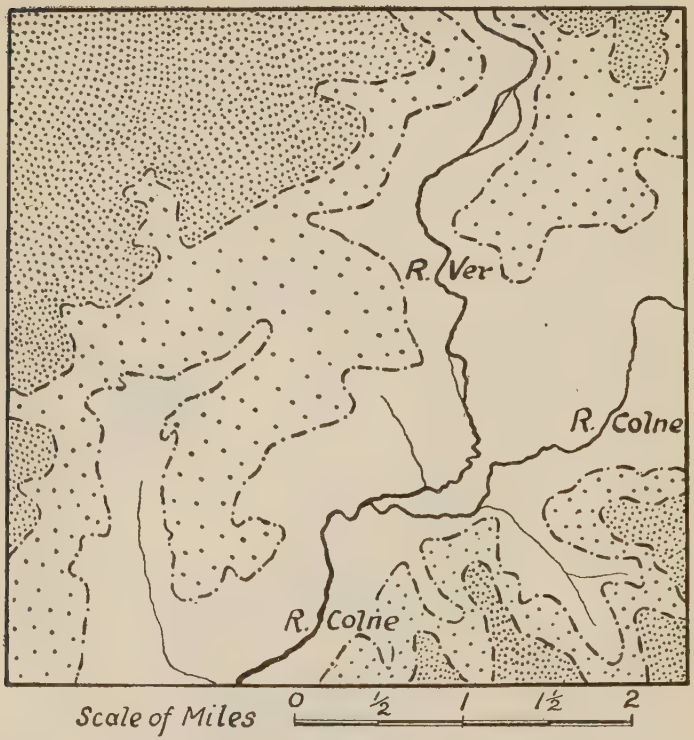


FIG. 11.—Diagram Map of the junction of the Rivers Colne and Ver.

250 and 300-feet contour lines —·—·—·—
Land above 300 feet closely dotted.
Valleys below 250 feet left blank.

eventually join as already described. Some idea of the way in which these rivers flow through these lowland "flats" may be gathered from the illustration, in which may be seen some of the meanders of the Colne on the

right of the picture, the Ver coming in on the left (see Plate V., *a*).

From this junction the river Colne flows somewhat more directly south by Munden Park and Otterspool to Watford, receiving more small streams draining from the clay ridge of Bushey and Elstree ; here, east and south of Watford, much artificial banking of the river may be seen, done partly to prevent the flooding of the low-lying ground in these parts. From Watford the Colne flows through the broad flats by Hamper Mill and Tolpits to receive the Gade and, a little farther on, the Chess, as already described. Then, by Batchworth and near Rickmansworth, the Colne goes to Mill End, from where it forms the county boundary to near Harefield, where it leaves our county to flow by Uxbridge to the river Thames. Over this latter stretch of the river Colne, that is, from its junction with the Gade, the canal and the river are not always easy to distinguish from one another—by Batchworth, Mill End, and Harefield—as we have seen to be the case with the canal and the rivers Bulbourne and Gade.

Before passing to the study of our other group of dip-slope streams it is important to notice that the waters draining south-eastward from the " divide " of the Chilterns, *i.e.* the rivers Chess, Bulbourne, Gade, and Ver, eventually become united with those which drain north-westward to the river Thame, for when the river Colne enters the Thames these waters are once more mingled.

The first of the eastern group of Hertfordshire's dip-slope streams is the river Lea, which, having its sources in the neighbourhood of Leagrave in Bedfordshire and passing through Luton and by Luton Hoo, enters our county at East Hyde where, for a short distance, it forms the county boundary. Flowing in the general south-easterly direction, the Lea passes Batford Mill with Harpenden and its well-known Common on the higher ground to the south-

west, through the delightful district of Wheathampstead, so beloved by the famous essayist, Charles Lamb. And so through Brocket Park, where the river is widened out to form a long, narrow lake, the Lea still flows south-east to within about a mile north of Hatfield, where it is again widened to form the beautiful Broadwater of Hatfield Park.

Here a most important change in the course of the Lea must be noticed; from its source to near Hatfield the direction is south-eastward, but now the river turns east and north-east. It has now passed definitely on to the lowland belt. Just as the river Colne flows south-westward to collect its group of dip-slope streams, so the river Lea flows north-eastward to collect the corresponding streams from its half of the county. As can be seen from the Physical map, the river Lea may well be likened to the river Ver, each flowing south-east down the dip-slope and on to the lowland belt, one turning north-eastward, the other south-westward. The river Ver, however, joins the river Colne, and though the former is the more imposing river, the combined streams take the latter name; the river Lea receives from the small "divide" no river worthy of giving its name as the Colne does to the Ver, and so continues its north-easterly course through the county under its own name. Over the wide "flats" between Hatfield and Hertford the Lea meanders, receiving small streams from the minor upland belt of the county, from the neighbourhood of Little Berkhampstead. Just before reaching the county town the Lea is joined by the next of the dip-slope streams; this is the river Maran (or Mimram), which has its sources on the Chalk uplands in the neighbourhood of the two Waldens and flows by Whitwell and between Codicote and Kimpton, receiving from the neighbourhood of the latter the small stream, the Kime. Thence the Maran goes by Welwyn and Digswell, where it

is crossed by the great viaduct of the London and North-Eastern Railway (see Plate V., *b*), and by Tewin Water and Panshanger to Hertingfordbury, receiving at several places waters which spring out from the lower levels of the Chalk. And now the Maran loses its south-easterly dip-slope direction and takes on the east and north-east direction of the lowland belt as it joins the main river. From Hertford to Ware the Lea continues its north-easterly course, and one might well be excused for mistaking it for a canal at some points. In this part of its course the Lea receives two more of the dip-slope streams, the rivers Beane and Rib. The former has its sources on the upper slopes of the lower Chilterns in the neighbourhood of Rushden (see Chapter VII., p. 34), and flows chiefly south and south-east by Walkern and Aston to receive a small stream, from the direction of Stevenage, near Frogmore Hall, and thence by Watton, and almost due south by Stapleford, and near Bengeo to the Lea. The river Rib has its sources on the upper levels near Buckland and flows a little east of south by Buntingford to Braughing, where it is joined by the river Quin, which drains the upper slopes near Barkway and Nuthampstead (see p. 34). From the junction of the two, the river Rib flows southward by Standon to near Thundridge, where it turns westward for a short distance and then southward again by Ware Park to the Lea. As we have seen, from Hatfield to Ware, the river Lea follows the line of the lowland belt, but at the latter place is an important change in direction; swinging south-east the Lea breaks through the minor upland belt between Hoddesdon and Bishop's Stortford.

The river Ash, draining from the slopes in the extreme east of the county in the neighbourhood of the two Pelhams and flowing by the two Hadhams, joins the main river between Ware, Stanstead St. Margarets, and Stanstead Abbots, where the Lea now flows through wide flat lands.

Very soon, in these flats, the Lea receives its last important "feeder," the river Stort; draining largely from the extension of our Chalk upland belt into Essex, the Stort becomes the county boundary for a short distance some 2 miles north of Bishop's Stortford; flowing south by the latter place and Sawbridgeworth, the Stort turns westward to near Rye House where it joins the Lea. Thence, east of Hoddesdon and Cheshunt, the Lea meanders in the wide-spreading flats to Waltham Abbey, where it leaves our county to flow through north and north-east London to the Thames. It is important to note that, as in the case of the rivers Bulbourne, Gade, and Colne, the rivers Lea and Stort have been used in canal making, and the "Lea and Stort Navigation" uses very largely the canalised rivers from Hertford through Ware and from Bishop's Stortford by Sawbridgeworth to the river Thames (see Plate VI., *b*).

Thus we see the two groups of Hertfordshire's south-eastward dip-slope streams, the Chess, Bulbourne, Gade, and Ver, and the Lea, Maran, Beane, Rib, Ash (with Quin), and Stort, gathered together into the two main streams, the Colne and the Lea. The Colne goes south-westward to pass round the southern end of the minor upland belt of the county, whilst the Lea flows north-east to pass round the eastern end of the same minor upland belt, the whole group being finally united in the greater Thames. To these must be added, also, the scarp streams of the north-west, which go by way of the Thame to the Thames, so that nearly the whole of the drainage of Hertfordshire's main upland belt, together with the smaller streams from the minor upland belt, forms a part of the Thames drainage. The small exception is the group of streams in the north-east of our county, going to the Ouse system.



(*a*) JUNCTION OF THE RIVERS VER AND COLNE, NEAR BRICKET WOOD.
[*Photo by A. N. Wilmore.*



(*b*) THE VIADUCT, WELWYN.
[*Photo by W. H. Smith & Co., Kingsway Series.*



(*a*) Gravel and Sand-pit near Royal Caledonian Schools, Bushey.
(See Chapter V.) [*Photo by A. N. Wilmore.*



(*b*) Carthagena Weir and Lock Broxbourne.
[*Photo by W. H. Smith & Co., Kingsway Series.*

EXERCISES ON CHAPTER VIII

1. Why is there so much of the upper parts of the Chilterns without any actual rivers ?
2. Try and find an example of a watershed or "divide," however small, in your own locality.
3. If a river in the Chalk area only flows at certain times, when would you expect these flows to occur ?
4. Trace the course of the river flowing nearest your home or school to the sea.
5. Why do you think the modern St. Albans has grown up on the higher ground instead of upon the site of the older Verulam on the lower ground ?
6. Name any other examples of Hertfordshire towns growing up on the upper slopes of the river valleys, and try to give reasons.
7. Rain falling at Tring may go to the sea by very different routes. Trace these.
8. Trace possible ways to the sea for rain falling on the watershed of the Chilterns at different points.

CHAPTER IX

CLIMATE, INDUSTRIES, AND COMMUNICATIONS

Climate.

In this brief account we cannot make any detailed study of the weather experienced in Hertfordshire ; we can only aim at a general idea of the **average** state of the weather—of the **climate**, as it is called. It should be clear from previous chapters that Hertfordshire cannot be regarded separately for this purpose ; it is one of the South-Eastern Counties, and shares in their general characteristics of

climate. Compared with the rest of Britain the rainfall is low, the winters cold, and the summers rather warm.

Within the county itself there are, of course, slight differences from place to place; the upland belt of the Chilterns, with its greater elevations, is colder than the lowland belt or the clay ridge, and has also a slightly greater rainfall. But we have already learned that the great Chalk belt is very porous; water soaks into the Chalk rapidly, and the atmosphere tends to be drier than it does over the more clayey districts, and whilst there may often be a cold, damp "feel" in the air of the southern parts in the colder months, or a moist, heavy "feel" in the warmer months, the wanderer over the commons and heaths of the Chalk belt may experience the bracing effect of the drier air, whether it be the invigorating cold of the winter months or the dry warmth of the summer.

Industries and Communications.

"Industries and Communications" do not come strictly within a study of the "Physical Features," but they depend so much upon the latter and lead to so many interesting studies and problems that a very brief note may be useful. The soils of Hertfordshire are generally fertile and its climate suitable, so that agriculture is by far the greatest industry of the county. Broadly speaking, the Chalk areas are suitable for cereals, whilst the heavier soils of the clayey southern parts, as we have already seen, are more suited to the growing of grass crops, and to dairy-farming. Although the area of plough-land has diminished in the northern parts of late years, this broad division still holds good, but it is interesting to notice the increase of dairy-farming in northern Hertfordshire, largely owing to the ease with which the produce can be sent to London.

Among the many other crops of the county we may

mention fruit, perhaps especially the cherries, grown in small orchards in many localities, whilst the richness of the alluvial flats, together with the ease of carrying to the great markets of London, the Midlands, and the North, accounts for the important watercress growing alongside almost every river. The same reasons explain much of the market-gardening so common in many parts of the county, the wide Lea valley perhaps deserving special mention. The growing of lavender on the Chalk areas has given rise to the somewhat uncommon industry of perfume-making, as at Hitchin and other places. Hat-making at St. Albans, and brewing at Watford, St. Albans, Hertford, and Ware, are examples of industries which date from the times when Hertfordshire was more entirely agricultural.

The reader should study the great roads and railways of the county, notice how they radiate from London and pass through the gaps of the Chilterns to the Midlands and the North, with Hertfordshire lying across many of the greatest routes. It will then be comparatively easy to study the many varied industries which have sprung up in almost all parts of the county, and to explain the great increase of population in recent years.

EXERCISES ON CHAPTER IX

1. Make as many observations as you can of actual temperature, rainfall, and direction of wind ; try and get to know the **average** for the whole year in your own locality, and compare with any figures you can obtain for other parts of the county.
2. Make a list of as many " crops " as you can in your own neighbourhood.
3. Explain the presence of the hat-making industry at St. Albans.
4. Take any industries in your own locality and try and explain why they are carried on there.

5. Study the roads or railways or canals in your own locality ; find where they go and, using the Physical map, try and explain the reasons for the routes they take.
6. Explain the saying, "Hertfordshire is rapidly becoming a dormitory for London."
7. Are any of the roads in your neighbourhood becoming more important, or are any new roads or railways being made ? Explain the reasons.
8. With the help of time-tables, plan a railway journey across the county from Rickmansworth, by Watford to Hertford or Ware. Then plan a journey *via* London and compare the distances and the time taken. What are the reasons for the differences ?

Section III.—THE PLANTS OF HERTFORDSHIRE

By ALDERMAN W. GRAVESON, J.P.

CHAPTER X

NATIVE PLANTS AND ALIENS

"Among the manifold creatures of God that have all in all ages diversely entertained many excellent wits, and drawne them to the contemplation of the divine wisdome, none have provoked men's studies more, or satisfied their desires so much as Plants have done, and that upon just and worthy causes."

This opening sentence, in sixteenth-century English, from the dedication of his Herbal in 1597 by John Gerarde, Master in Chirurgerie, to "the right Honorable my singular good Lord and Master, Sir William Cecil, Knight, Baron of Burghley, and Lord High Treasurer of England," may serve as an introduction to an account of the Flora of Hertfordshire, for it marks the connection of the ancestor of a noble Hertfordshire family with one of the first books on the country and garden plants of England. In this Herbal, Gerarde refers to a number of the plants which he describes as growing in the county, including Canterbury Bells, Butterwort, Flowering Rush, Lily of the Valley, Bee, Fly, and Butterfly Orchises. He refers to these latter under their old name of Satyrions, adding, "They grow at Hatfield neere S. Albons, by the

relation of a learned Preacher there dwelling, M. Robert Abot, an excellent and diligent Herbarist." Hatfield is connected with another writer who deserves to be remembered, Mr. Alfred Reginald Pryor. It is to him that Hertfordshire owes the county flora published in 1887, though he himself was prevented by death from seeing the completion of his work. Some forty years earlier two other botanists had compiled the *Flora Hertfordiensis*, the first attempt to collect information on the plants of the county, and where they grow. The two men were the Rev. R. H. Webb, Rector of Essendon, and the Rev. W. H. Coleman, Master at Christ's Hospital, Hertford. Their "flora" has no small value, and the quotations from poets and from folklore add to its charm.

In the forty years that have passed since Mr. Pryor's notes were compiled, there have been many changes in the flowers of Hertfordshire. Some of those that were rare have disappeared from old habitats; others that were then rare may now be ranked amongst the county plants. These comings and goings of flowering plants will be considered presently, but before doing so we may explain that writers on flowers are not always agreed on what must be considered a distinct species.

In 1887 there were recorded in the Flora and Appendix	923
Casuals, aliens, etc.	193
Total	1116

The total of all species in Bentham's well-known book of flower illustrations is 1315, the total in another famous book, the *London Catalogue*, is 2075. From this we see that the Hertfordshire total is about one-half of that of Great Britain and Ireland, if the aliens are excluded; if these are included, the proportion is more than half. When we remember that the area of Hertfordshire is com-

paratively small, that it does not touch the sea, and therefore is cut off from the flowers of the seaside, that it has no high mountains, we may fairly claim that the county has quite a fair share of the wild flowers of Britain.

Returning to the division into two groups of the plants observed in Hertfordshire, native plants and aliens, we must remember that it is impossible to draw a hard-and-fast line. A flower may be considered as naturalised if it establishes itself in such a way as to grow freely alongside the old residents. It is a most interesting subject to follow the history of some plants which have come quite recently, but space will only allow of reference to a few of them. Their story will, however, show what has taken place in the past, and is taking place at the present time. In the 1849 flora, Buxbaum's Speedwell, now one of our commonest weeds, was described as rare, and only some half-dozen places are mentioned in which it occurred. In the 1887 flora, it is recorded as "widely distributed, and now far from rare." For the last thirty years I have been accustomed to see the pretty, china-blue flower of this speedwell in almost every arable field around Hertford, and in allotments during the months when the ground was not being worked. Another alien which arrived in England about the same time as Buxbaum's Speedwell, the Whitlow Pepperwort, has been longer in taking up residence in the county. It was first recorded at Hitchin in 1873; a little later it was seen near Ware Park mill. Now it is well established. A still more remarkable instance of an introduced plant establishing itself is that of the American Waterweed. It arrived in England in the forties of last century and in a few years spread in such an amazing manner as to overrun ponds and rivers, seriously affecting navigation, and causing much annoyance to boatmen and fishermen. It does not seem to have reached Hertfordshire when the 1849 flora was

published, as it is not mentioned therein, but in 1856 the river at Watford was nearly choked with it. Happily this American invasion has now spent itself, for the plant is not so troublesome as it was. A more recent comer is that plant called the Rayless Feverfew. I remember having this plant pointed out to me as a rarity thirty years ago. Now its green rounded discs are constantly found in waste places, and it is unusual to take a country ramble without seeing it. If the county has allowed these undesirable aliens to settle, it has also received some welcome immigrants. Chief amongst these is the Mimulus, commonly called the Monkey-flower. It was introduced from America about 1826 as an ornament for gardens. In many parts of the country it found its way from the home to the wild garden, and the 1849 flora records it as having been found by the river Hiz below Hitchin. In 1887 there are records of its occurrence near parks by the side of the Colne, the Lea, and the Maran or Mimram. Since then the plant has travelled down the Lea to the Essex border, and in many places its handsome flowers add no little beauty to the river bank (see Plate VII.). Another welcome invader is the tall Balsam, with bright orange-red flowers, which has established itself along the Colne and the Grand Junction Canal. The last example of a plant which was once rare and has now become quite common is furnished by the Rosebay Willow-herb. Its record in the 1849 flora is "woods on a moist sandy soil and in osier beds, rare"; about half a dozen places are mentioned. Nowadays this handsome willow-herb is one of the best known of our woodland flowers. Whenever the undergrowth is cut in a wood, it takes advantage of the opportunity to spread itself, and its feathery seeds obtaining foothold, the next season sees a forest of tall stems crowned with the familiar long spikes of rich purple flowers.

The number of introduced plants has probably been

greater in the past sixty or seventy years than in any previous period of double this length. Some come with corn or clover seed, or with chicken food; some with imports of wool and other raw materials. There is an immense number of these aliens in certain parts of the British Isles. Just now I am watching with interest the spreading of three or four handsome Anchusas over a disused gravel pit in the hope that they may make a home for themselves alongside Houndstongue and Bugloss.

One way of realising the changes that occur year by year in the flora of the countryside is to observe what takes place when a gravel pit is excavated. The most interesting instance of the kind in the neighbourhood of Hertford is afforded by an extensive pit at the eastern end of the town. Some thirty years ago the ground formed part of a pasture similar to that of the adjoining meads, and was adorned with Buttercups, Daisies, Clovers and Trefoils, Meadow Saxifrage, Salad Burnet, Yellow Rattle, etc. Save for a few stragglers these old residents have vanished, and plants like Coltsfoot, Thistles, Kecksies, Burs, and the weeds ever on the look out for new settlements have now taken their place. The fight for possession has been continual, and though there has been too much domination of the land by such obnoxious invaders as Nettles and Mugwort, there have been beautiful colour effects produced by yellow Ragwort and Toadflax, the purple of Musk Thistle, and Codlins and Cream Willow-herb. The excavation of the gravel has been followed by the percolation of water, especially in those parts of the pit near the Lea, and by the formation of large ponds. In these and around their edges numerous water-loving plants have flourished, Reed Mace and Water Plantain being especially noticeable. Sallows and Willows have also put in an appearance, and through the agency of birds, bushes of Bramble, Thorn, and Wild Rose. One August morning,

in the course of an hour's flower hunt, two of us counted 130 species of plants in bloom in this pit, and there were a score or two more which had finished flowering. There are remarkable changes from year to year. Four years ago refuse was brought from a city area, and dumped into one of the pools of water so as to fill it. In the following year, there appeared a rank growth of Goosefoots ; next year these had diminished, and some tall Sisymbriums reigned instead ; in the third year Mugwort had taken their places. Usually it is in the first season after the deposition of river dredgings or dumpings that the most interesting plants spring up. On one such heap of river dredgings sixty species of plants appeared, including several rare species of Vetches. Alas, by the next summer " hateful docks " and Nettles took over the ground. Such observations as these throw light on the making of a countryside flora. It would be most interesting if we could trace the story of many of those cornfield weeds that are now habitual residents of our arable fields. It may be they arrived with seed centuries ago and made full use of the opportunities offered to them. This is a fine field of study for boys and girls.

And now let reference be briefly made to changes which have taken place amongst some of the old native plants. The past century has dealt unkindly with many of these, and their lot becomes harder, and their continued existence more and more doubtful. The drainage of land has been the doom of some, like Sundew and Butterwort. A prolonged drought, like that of the summer of 1921, might seriously affect others. The removal of hedgerows, or their close cropping, are other sources of danger. Add to this the raiding of some flowers, such as primroses, the uprooting of ferns for gardens, and the misguided keenness of young people who sometimes collect rather foolishly, and it will be realised that the future of some of our county

flowers is not hopeful. In my own neighbourhood I have marked the disappearance of Sheep's Scabious, from the bank on which it used to grow, and it must now be twenty years since the Grass of Parnassus bloomed in the pastures by the Mimram. A small colony of Wood Cudweed disappeared when its home was selected for the stone dump of a rural council, and a clump of Pennyroyal was consumed by a bonfire celebration of some notable event. Similar instances could doubtless be multiplied from other parts of the county. We should all do what we can to preserve some of the rare plants in the county from the greed of collectors. The County Council has certain by-laws which were drawn up to protect ferns and wild flowers. Boys and girls should never collect recklessly, and on no account should they pull up flowering plants by the roots. It is hoped that every reader of this book will make it a duty to help in the preservation of our wild flowers. To collectors who are anxious to have their herbariums complete, may I commend the example of two worthy botanists, who on visiting the habitat of one of the rarest of Hertfordshire plants reported, "We found a Gentiana that we never saw before, about 5 or 6 inches high, very bright blue; but seeing only one plant we made a memorandum and left it." This Gentian is now more numerous. Nowadays the right course would be to add to one's memorandum of such a rarity a photograph of the plant as it was growing, and such a possession would surely give more pleasure than any dried specimen in an herbarium.

CHAPTER XI

THE PLANTS IN THEIR HOMES

HAVING noted some of the changes that have taken place in the flora of Hertfordshire during recent years, let us now turn to the distribution of plants in the county. The plan followed in the two county floras referred to before was to describe the habitats of the plants in the various botanical districts into which Hertfordshire was divided. These were founded on the river basins of the Ouse and the Thames; the former comprising those of two tributary streams, Cam and Ivel, the latter those of Thame, Colne, Brent, and Lea.[1] A glance at the map will show how unequal these divisions were in area, and the difference in size affected the totals of the plants found in each. Such an arrangement was well suited to the particular purpose at the time, but in a brief account of Hertfordshire plants it will be better to consider them on the lines of modern ecology, and it is proposed to consider some of the chief groups or associations, namely, those of woodland, heaths and commons, grasslands, aquatic and marsh, cultivated land, hedgebank, and walls.

Flowers of the Woodlands.

Enormous changes have taken place in Hertfordshire since the days when the Britons retired to their forests to escape the Roman soldiers. Between those days and the coming of the Normans no doubt many woods had been cleared, but to judge by the entries in Domesday Book of the extent of "woodland to feed swine," much of the forest remained. In the seventeenth century the

[1] See Chapter VIII., Section on Physical Geography.

country along the Middlesex border was a favourite hunting ground, deer then being numerous; at the present time there are extensive oak woods. The woodland plant associations of the county are chiefly those of the oak and beech woods. The oak woods are more numerous in the south-eastern part of Hertfordshire, the beech woods along the line of the Chilterns to the north and north-west. The oak woods are of two types, Oak-Hornbeam and Oak-Hazel.

Though there are tall Hornbeams and old pollards with quaint growth, this tree is more usually seen as undergrowth, attaining a height of a dozen or so feet, and is coppiced at intervals of ten to twelve years. Bracken covers considerable areas in some of these woods, and where it flourishes ground plants are scarce. When bracken is absent there is often a thick growth of Dog's Mercury, its green flowers showing in January, and in summer a vigorous growth of Wood Sage, or it may be Enchanter's Nightshade, Knotted Figwort, two or three species of St. John's Wort, and the Broad-leaved Willow-herb. There is frequently a number of more lowly plants in the undergrowth, such as Common Speedwell, Mountain Speedwell, Bugle, Dog Violet, Wild Strawberry, Cow-wheat, and less frequently Lady's Mantle, Wood Sorrel, and Woodruff. A few woods near Hertford harbour Twayblade, Butterfly Orchis, Herb Paris, Tutsan, and Golden-rod; there are three small colonies of Fœtid Iris; and on the outskirts of these woods are some ponds, in which the prettily fringed Buckbean, crimson Marsh Cinquefoil, Cowbane, and insect-catching Bladderwort may be found. As a whole these woods lack colour, especially when the undergrowth is thick; hence the delight one experiences from the fragrant catkins of Goat Sallow and Round-eared Sallow in early spring, and later on of pink-flushed blossom of Crab Apple, and the dazzling

white of the Wild Cherry, the queen of the spring woodlands. After the Oaks have settled down to their summer foliage, there is widespread greenness, till the Bracken changes to the mellowing yellows of autumn, and the Oaks follow with their olive-brown leaves. In open spaces there is more colour, especially if Foxgloves abound, and Rosebay Willow-herb is spreading; and the "rides" are often adorned with Spotted Orchis, yellow Wood Pimpernel, Tormentil, pink Centaury, and in damp hollows with golden Moneywort.

In the oak-hazel woods, Wood Anemones open their white starry flowers in myriads to greet the spring sunshine, with Primroses and Wood Spurge, followed by Hyacinths. Hours pass too quickly when the sea of blue and purple spreads through the wood, broken by groups of Yellow Archangel and masses of bright Red Campion, with here and there spikes of Early Purple Orchis. In these woods, too, flowers vanish as the foliage thickens. Trees play the part of protectors to plants against cold and wind in the early months of the year; but after May, when the trees are in full leaf, they hinder the growth of the smaller plants underneath by cutting off so much of the sunlight. Hence the woodland plants must flower early, and this is helped by the food stores in the root tubers of Lesser Celandine, the rhizomes of Wood Anemones and Winter Aconite, and the bulbs of Hyacinths, Snowdrops, and Daffodils (see Plate VIII.). The last of these is, alas! sorely raided about Eastertime. Snowdrops and Aconites have probably been introduced into the county, but they have now quite established themselves.

The Beech, as before mentioned, is chiefly a tree of the Chalk hills. Stately at all seasons, it charms most when the young leaves are unfolding in spring, and when it is decked in its robe of gorgeous colour in the late autumn. Its

plant association is more limited than that of the Oak, for the Beech does not encourage settlements under its spreading branches; its foliage is closer, it casts a deeper shade, and the thick deposit of leaf and mast does not permit of much ground vegetation. Dog's Mercury manages to maintain a hold, and so do Wood Sanicle, Enchanter's Nightshade, and three or four orchises. The handsome Egg Orchis, with its spike of creamy flowers, looks at home in beech woods; the Bird's-nest Orchis even draws a food supply from the fallen leaves, as also does the Pine Bird's-nest, though its drooping head is not suggestive of pride in its diet. On the edge of the wood Privet and Wayfaring Tree may be seen, and in a few localities there are White Beams, which show themselves when the wind tosses to and fro the gleaming undersides of their leaves.

Boundary hedges of many of the old woods are rich in berry-bearing trees and shrubs. Now that the glory of the old hedgerows by the highways has largely departed, we turn with all the more affection to the woodland boundaries, or to the country lanes far removed from modern traffic. It is worth a long walk to see the early display of snowy Blackthorn, set in between the freshly green leaves of the Whitethorn, and to return when the May bushes are in their prime, or later still when dainty Wild Roses climb aloft, letting fall long arms bedecked with pink flowers. Other hedgerow climbers are glossy-leaved Black Bryony, and the rougher-leaved White Bryony, and, especially on a chalk soil, Clematis with its creamy flower clusters, and the feathery seed heads, which have gained for it the name of Old Man's Beard. And chief favourite of all by reason of its fragrance is the Woodbine. When autumn arrives the show of berries rivals that of the flowers, purple sloes with blue bloom, scarlet hips varying in size, crimson haws, orange Bryony berries, and the jet fruit of Blackberry. Less widely distributed

are the two Buckthorns and the Spindle-tree. The last makes amends in late autumn for the small green flowers of early summer by its brilliant fruits, coral-pink outside and orange within. Water Elder with its bright red berries may be seen in moister situations.

Berry-bearing trees and shrubs form no small part of the scrub that extends from the woods, when waste and derelict land is close at hand; and the bushes gather around them a varied plant community. An instance of this nature was furnished by the ground above a tunnel on one of the railway lines of the county. The excavated Chalk had been piled above the tunnel, and in the course of some seventy years there had grown up trees and tall shrubs, the open ground between being covered with a rank growth of Chalk-loving plants—Marjoram, Small Scabious, Thyme, Calamint, together with Thistles and Burdock. The trees included Wild Cherry, Elm, a White Beam; there were some tall Hazels, Hawthorns, and straggling growth of Brambles and Roses. A study of the formation and composition of the large scrub areas, such as those at Bricket Wood and Hertford Heath, would be of much interest. Some years ago Dr. E. J. Salisbury made a special study of these areas, and those at Kingsland and Markyate, and published the results of his observations in the *Transactions of the Hertfordshire Natural History Society*.[1] The paper includes a table of the flowering plants growing in each of the scrubs; the record of the respective areas is—Kingsland 125, Markyate 96, Bricket Wood 136, Hertford Heath 99.

The Plants of Heaths and Commons.

The mention of Hertford Heath leads up to the plants of the heaths and commons of the county. Hertfordshire does not possess the wide heathlands of some of the

[1] Vol. xvii. part i.



MIMULUS.



(*a*) Lesser Celandines.



(*b*) Snowdrops in Panshanger.

counties south of the Thames, or anything resembling the sandy heaths of Suffolk. The gorgeous purple Fine-leaved Heath is practically unknown within the boundaries of the county, the pretty pink bells of the Cross-leaved Heath are only found in one or two places, and in place of the rich growth of Scotch Heather, a growth which readers of R. L. Stevenson will remember provided a hiding-place for his two heroes, David Balfour and Alan Breck, the plants of Ling are rarely more than a few inches high. Frequently associated with Ling is the Dwarf Furze, and in late summer the combination of purple and gold gives rise to some beautiful colour displays. Even more captivating is the glory of the Common Furze, when its tall bushes are crowded with golden blossom, and their nutty aroma is wafted abroad. Both species of furze are well armed with spines, and this explains why the cattle of the commoners let them alone. Similar protection is afforded to other shrubs of the commons—Petty Whin, Blackthorn, Hawthorn, Rose, Bramble, and Holly. The plant associations of these commons illustrate mutual helpfulness. The shrubs armed for their own defence give protection to their weaker brethren, and these respond by making pretty edgings of colour around their defenders; as, for instance, when the starry white flowers of Stitchwort grow among the black twigs of the Sloe, and Bluebells show forth from the tangle underneath the Bramble; or again in the pink clusters of Lousewort among dwarf Creeping Willow and Petty Whin. Heath Bedstraw keeps more in the open, and is let alone by the cattle for some other reason.

Though the grasses are not provided with organs of defence, their matted roots and tufted growth, with the quick renewal of their leaves, ensure not only their preservation, but provide nourishment for the cattle and horses of the commoners. Sheep's Fescue and two or

three of the Bent Grasses are the most plentiful. Where the soil is somewhat peaty, Mat Grass and Purple Moor-grass are found. Then there are the Common, Hard, and Jointed rushes, and the dainty little Field Wood-rush, with its bright yellow stamens and brownish flower clusters. It has two woodland relatives, Hairy Wood-rush, 6 inches high, and the Great Wood-rush running up to a couple of feet. There are a few dwarf sedges, such as the Early and Pill-headed species.

The Plants of the Grasslands.

Turning to the plants of the grasslands, let us begin with the oldest settled of these, namely, those of the open Chalk hills. It seems probable that these grasslands, which we know best by the name of downs, have altered little from long-past ages, and that in many parts they were open country when most of the land was forest. The Hertfordshire downs have not been made famous by poet and naturalist like the country from Eastbourne to Chichester, but the praises of Richard Jefferies and W. H. Hudson, and the flower verses of Rudyard Kipling, are true of the line of hills which enter Hertfordshire near Royston, and bound the north-western side of the county from about Hitchin to Tring. The downs are the delight of all who know them, and there is no pleasanter walking than on their springy turf, and no such feeling of restfulness and peace as they bring, especially on sunny days of autumn when the breeze is so light as scarcely to waft abroad the feathery seed of the purple Stemless Thistle from the midst of its rosette of leaves spread close to the ground. As Jefferies has well said of such days, "The peace of the sky overhead is reflected in the silent earth." Yet another charm arises, from the fragrance of the down plants, chief among them being Thyme and Marjoram. Hudson records how his room at night-time was pervaded

by fragrance after an afternoon repose on a bank of Wild Thyme. And here let me recall the chapter, "The Living Garment," in his book, *Nature in Downland*, where he describes this experience; it is a masterly and affectionate tribute to the glowing flowers of the Chalk hills.

The down flora has two great bursts of colour: one of early summer, the other of late summer and early autumn. Up to mid-May the hills have few flowers, though in the previous month there are groups of light purple Hairy Violets, short Cowslips, and, in favoured localities, the lovely Pasque Flower, with its purple corolla, golden stamens, and silky calyx. It is the nearest approach to the flowers of the Alps that the southern counties provide. Should the spring have an adequate rainfall, the Chalk hillsides glow with colour in the early summer, with wonderful masses of yellow Rock-rose, Bird's-foot Trefoil, Horseshoe Vetch, Lady's Fingers, small Trefoils, and the taller growths of Long-rooted Cat's-ear, Common Hawkbit, Hairy Thrincia, or Lesser Hawkbit, and the paler lemon of Mouse-ear Hawkweed. There are also spikes of silvery Hoary Plantain, slender stems of white Cathartic Flax, ragged heads of Salad Burnet, Milkworts pink, red, blue, and white, as though the plant would press as many colours as possible into its service, and the general favourite, "the windbit thyme that smells like dawn in Paradise." Amongst the sweetest hours in the year are sunny mornings on the Chilterns in June, when there is this glory of colour around, and the lark is soaring aloft with his ethereal song. In addition to these widely spread Chalk hill plants, there are others prized both on account of their beauty and rarity. The Orchis family is particularly well represented. One of the earliest to bloom is the dainty dwarf Burnt Tip Orchis, with dusky-tipped flowers; then follow the clove-scented Fragrant Orchis, the Bee Orchis (see Plate IX., *a*), the most familiar of our flower mimics, and in the early autumn

the charming little Lady's Tresses, as sweet as it is pretty. In a few places good fortune may reveal Fly Orchis in the rough grass alongside a beech wood ; and other uncommon local plants are a dwarf ragwort, called Field Fleawort, Purple Milk Vetch, and Mountain Everlasting.

In late summer, though there are still many yellow flowers, purple is the more noticeable colour. Marjoram now succeeds Thyme, Calamint and Betony abound, Basil Thyme creeps over the ground. Clustered Bell-flower raises its head of deep blue with the lighter blue of Harebell, and Autumn Gentian opens its purple corollas to the sun ; there is Yellow-wort, fragrant Squinancy-wort, and abundance of Eyebright, bewitchingly beautiful with its yellow eye and honey guides. The down thistles are dwarf, like so many of the plants ; Carline Thistle with straw-coloured rays, and the single purple bloom of the Stemless Thistle. Very many of the plants of the downs are small. The sheep and the rabbit keep down the stature of the plants. Where free from such attacks, as when growing amongst the longer grasses of the lower slopes, several of these species are much taller, as, for example, the Small Scabious and Clustered Bell-flower. They combine with Ragwort, Knapweeds, Marjoram, and Calamint to make brilliant displays of colour. In the rough pastures underneath beech woods there are frequently similar displays, and again in the vicinity of old Chalk pits. Some of these plants have no small attractiveness : the stately Great Mullein with big flannelly leaves and long flower spike, whereby its name of Virgin Mary's Candle ; the more elegant Black Mullein, Ploughman's Spikenard, with its pleasing scent, Dyer's Rocket, Cut-leaved Mignonette, yellow-umbelled Parsnip, Carrot with its bird's nest seed-head, dainty heads of Vervain, bristly cones of Teasel, Burdock with clinging burs, yellow Agrimony and dull red Hound's-tongue, both persistent in fastening their seeds on

passers-by, and Viper's Bugloss with purple-blue spikes and bristly leaves. How successful are some of these burfruited plants in enlisting the services of animals to carry their seed is shown by their colonies around a rabbit warren.

Flowers of the Meadows.

From the flora of the downs we pass naturally to that of the pastures, meadows, and commons. There are numerous variations in this grassland flora due to soil, situation, and pasturing of sheep and grazing of cattle. Rough pasture land provides quite a number of the flowers already mentioned, with the addition of Meadow Vetchling, Dyer's Greenweed, Restharrow, Yarrow, Sneezewort, Yellow Bedstraw, Spear Thistle, Marsh Plume Thistle, Burnet Saxifrage, Pepper Saxifrage, Bastard Stone Parsley, and Devil's-bit Scabious. The purple mist which the last of these throws over a pasture is one of the delights of late summer. Narrow-leaved Ragwort and the common species, St. James's Wort, are often plentiful, and in heavy clay land, with a preference for moist situations, Fleabane is commonly found. In better pasture land the herbage is short, and on commons near villages or hamlets a close cropping takes place, with the result that the plants are of a dwarf character, with the exception of the buttercups, for example. There is a great contrast between the pastures and hay meadows. These latter vary with their soil and situation, and the grass crop is greatly affected by the rainfall in spring and early summer, or by a prolonged period of hot sun, as was the case in the summer of 1921. When the season is favourable, several species grow well ; amongst these are Sweet Vernal-grass, Timothy Grass, Meadow Foxtail, Yorkshire Fog, False Oat, several Fescues and Meadow Grasses, Perennial Rye-grass, and Creeping Bent. By the hedges of the fields, Tall and

False Brome-grass are frequent, and where the soil is damp, Tufted Hair-grass. Most attractive of all is the pretty Quaking Grass. Several of the grassland flowers are amongst the chief favourites of children—Daisy, Buttercups, Cowslip, Moon Daisy. Children have their pet names for these flowers, and for others like the Meadow Saxifrage, known to them as Milkmaids, and Meadow Orchis as Cuckoos. The name cuckoo is more usually associated with the Lady-smocks, the flower which Izaak Walton describes children as gathering in the Lea meadows, with Lilies, Culverkeys, and Cowslips. The campion of the water meadows, better known as Ragged Robin, is sometimes called Cuckoo Gilliflower. What glorious colour displays these meadow flowers make, " the wild marsh marigold that shines like fire in swamps and hollows gray " ; Buttercups, " their million, million drops of gold amongst the green " ; Lady-smocks, " all silver white," which with " Cuckoo buds of yellow hue do paint the meadows with delight " ; Daisies, " the pearled Arcturi of the earth." Well may poets sing their praises, and when we see a field of Dandelions ablaze in May we can understand the praise of the American poet, Lowell. Then there are the multitudes of Ox-eye Daisy, the masses of pink Ragged Robin, sturdy Cow Parsnip, dwarf Yellow-rattle ; and along the hedge banks Cow Parsley. Some of these plants are ill friends to the farmer, Yellow-rattle being semi-parasitical on the grasses, an evil habit in which even the dainty little Eyebright indulges. Amongst the rarer grassland plants are Bistort and the bells of the Fritillary.

Coming again to the plants of the pastures and commons that are grazed, it will be noted that quite a number of them set their leaves close to the ground. Such are Common and Ribwort Plantain, Daisy, Cat's-ear, Autumnal Hawk-bit. This habit serves the double purpose of allowing less

grip for the grazing cattle, and of elbowing out any near competitor. White Clover, Strawberry Clover, and two or three of the smaller trefoils have also a dwarf growth, and so have Silverweed, and Camomile, the plant of which Shakespeare writes, "The more it is trodden on the faster it grows." [1] Self-heal, again, succeeds in holding its own, and in marshy hollows so do Marsh Cudweed, the two Bur-marigolds, and three or four species of Polygonum. Where the soil is sandy, the minute pea-flower of the Bird's-foot and the pink corollas of the Sand-spurrey may be found.

Plants of Water and Marsh.

On many of the commons there are natural or artificial ponds. Favoured commons like that of Hartham, at Hertford, are bounded by streams, and share with the water meadows along the Hertfordshire rivers in another of the plant groups—the water and marsh vegetation. We know that there have been many changes in the streams and ponds of the county since the dawn of history. Probably the greatest change was brought about by King Alfred, when he constructed the dam stopping the tide from coming up the river Lea. We may well wonder how many kinds of plants Hertfordshire lost by the Saxon King's action. Since then changes in the channel of the Lea for navigation purposes have affected the flora of this river; the drainage of marsh and swamp have had similar results elsewhere. Some plants have disappeared, and others have, as was pointed out earlier on, been introduced.

The aquatic plants may be roughly divided into two groups—the one of species growing habitually in the water, and the other of species growing along the margins of rivers and ponds. In the former group, with the exception of Water Crowfoot, there is little sign of flower before

[1] *Henry IV., Part I.*

June. It is when the sun raises the temperature of the water that the Pondweeds show their leaves and flower spikes, and the Water Lily pads come to rest on the water, and the yellow cups begin to open. White Water Lily, though it has lost old habitats, has been introduced, as in a pond near Hertford, and Water Soldier into one near Hitchin. The most beautiful display of an aquatic plant is that of Water Violet in an old channel of the Lea near Ware; for about 200 yards it sends up multitudes of stems topped with lilac blooms, each set with yellow eye. Water Crowfoot, starring the ponds or forming white islets in the rivers, is also a delight. In summer there are pink groups of Persicaria, stately white Water Plantain, and the dwarf Arrowhead. Showy flowers are the exception, and for the most part the plants living in the water have small floral organs, as is the case with Mare's-tail, Hornwort, Duckweeds, Starwort, or unatttractive ones like those of the Pondweeds and Milfoils.

Passing to the plants that grow by the side of the river or ditches, we find a gayer flora. A start is made by the pink heads of the Butterbur in February, and the lowly Golden Saxifrage a month later; then follow creamy Comfrey, and dark spikes of Common Sedge. May brings with it the blue Brooklime, lavender Water Speedwell, and Forget-me-not, the river-side favourite that carries romance in its name. Water-cress flourishes in shallow streams, its relative Great Water Radish in deeper water, and Marsh Water-cress on the river bank. June brings the handsome Yellow Flag, which is followed by the summer display of Great Valerian, Meadow Rue, Codlins, and Cream Willow-herb, foamy heads of Meadow Sweet, Purple Loosestrife, Angelica, Hemp, Agrimony. River banks are a delight with the medley of colour these tall plants provide. With their roots more often in the water are Bur-reeds, Flowering Rush, Cat's-tail, commonly called

Pokers, and Great Water Dock with huge leaves, and in a few localities, Sweet Sedge. Amongst the riverside plants may also be noted several Willow-herbs, blue Skullcap, Square-stalked St. John's Wort, the Clown's Woundwort mentioned in the Herbal of old Gerarde, Gipsywort, Marsh Bedstraw, Narrow-leaved Water Parsnip, and the sprawling Procumbent Marshwort. Some of these species frequent the swampy parts of the water meadows, and here they are associated with Small Valerian in late spring, and Lesser Spearwort, followed by bright masses of yellow Water Ragwort, and light purple Mint in summer and early autumn.

Several of the grasses and sedges are amongst the attractions of the riverside flora, by reason of their tall stems and their rich flowers (see Plate IX., *b*). The breeze causes them gracefully to bend, and to give forth a pleasing murmur. In the early summer the Great Pond Sedge with its large drooping spikelets is the most noticeable, and along with it may often be seen the tussocks of the Tufted Sedge. Later on appear the three tall reed-like grasses, Reed Canary Grass, Reed Meadow Grass, and Common Reed, the last betokening the approach of autumn. Floating Meadow Grass, Water Whorl Grass, and Floating Foxtail grow in the water, their leaves resting on the surface. Tall rods of the Bulrush rise to a height of 4 to 6 feet, wind and current causing them to sway. By upland ponds the Cyperus Sedge is frequently found, and by a few brooks in wooded districts the large and handsome Wood Club Rush may be seen.

Plant Associations of Cultivated Lands.

The three divisions—woodland, grassland, and aquatic plant associations—may be regarded as natural. There are, however, a vast number of species that are more or less dependent on the cultivation of the land, and which appear

with crops of corn, clover, or roots. Several of these are the most troublesome of weeds, causing enormous damage to the farmer ; nevertheless, their gorgeous colour displays would be much missed if all occupiers of the land cleaned their fields like Tennyson's Lincolnshire farmer, so that " I niver not spied sa much es a poppy along wi' the wheat." With such a long list of plants associated with cultivation, reference can only be made to a limited number. The most marked colour effects are those of Red Dead-nettle in allotment ground in early spring, and Yellow Charlock and Mustard with the young corn ; next come the blaze of Poppy, an occasional blue drift of Corn Blue-bottle, or of yellow Corn Marigold. Lilac Scabious, purple Knapweeds, yellow Corn Sowthistle, and blue Chicory give a medley of colour to cornfields after midsummer. Too often they are accompanied by the Creeping Thistle, most troublesome of all the family, and on heavy land with the evil-smelling Camomile. Other foes are the small Convolvulus, and the Climbing Persicaria or Corn Bind-weed, both entangling the stems of corn. Of the less known weeds of cultivated land, there may be recorded Radish, Fumitory, Corn Crowfoot, Shepherd's Needle, Fool's Parsley, Lamb's Lettuce, Corn Spurrey, Bartsia, Corn Mint, three dainty species of Toadflax, Small Snap-dragon, Knotgrass, Spurges, grass plagues like Couch Grass and Docks, and many other plants.

The clover fields are invaded by some of the plants in the above list, and, introduced with their seed, a rare stranger may now and then be found, as, for example, St. Barnaby's Thistle. The two common Clovers, the Red and White, are welcome for the rich colouring of the one, a richness excelled when there is a field of the taller Crimson Trefoil, and the sweetness of the other. Its white heads are good friends to the bee-keeper. Frequently the clover is mixed with other trefoils, and Black Medick, or there are fields

of Common Vetch, purple Lucerne, and bright pink Sainfoin. White Campion frequents fields of clover, and before the crop is fully grown two or three of the smaller Crane's-bills and the Hemlock Stork's-bill may be espied, and so may "the little western flower before milk-white, now purple with love's wounds," the Pansy. Love-in-idleness is but one of a score or so of country names for this flower. The Scarlet Pimpernel of arable fields is another favourite, its pretty red corolla with deep purple eye being the more welcome for carrying with it the promise of a fair day; because it responds to weather conditions it is called Poor Man's Weather-Glass and Shepherd's Warning, and it shares the name "Jack-go-to-bed-at-noon" with the Goat's-beard.

Occasionally Dodder may be seen, winding its reddish threads about the clover, and displaying its cluster of small pink flowers. Broom is attacked by the Great Broomrape, which sends up a dull brown stem and flower spike a foot or more high. One of its relatives, the Tall Broomrape, selects Greater Knapweed for its host; a third, the Blue Broomrape, makes choice of Yarrow, whilst the Small Broomrape attacks Clover, Thistles, Carrot, and Ivy.

Hedgebank Plant Associations.

Though hedgebanks cannot claim any distinct plant association, they have, together with the grassy margins of the roads, a special interest in providing homes for the plants of the woodland and grassland, and where the soil is disturbed, for those of cultivated land. There must be many a contest for possession of the ground between the different members, and this may account for the great variety of flowers which our hedgebanks and roadsides display. But whilst forming no separate flora of their own, there are quite a number of individual plants, which

seem more at home on the hedgebanks than they do anywhere else. For instance, the perfume of Sweet Violet is especially associated with a hedgebank warmed by the sun of March and April ; Lesser Celandines expand their yellow stars in multitudes ; Jack-by-the-hedge stands in battalions, along with Stitchwort, and nowhere does Germander Speedwell greet us in more bewitching manner with its blue bird's-eye. Ground Ivy is more at home in the hedgerow than elsewhere ; the same may be said of Herb Robert and of the Cuckoo Pint with its curious hood. In summer downy-leaved Woundwort, Black Horehound, and Mallows are common. Some of the Umbelliferæ seem to have a distinct liking for the hedgebanks, beginning with the rich growth of Cow Parsley in May, followed by Chervil, Cow Parsnip, Upright Hedge Parsley, and less frequently by the spotted-stemmed Hemlock. Then there are the vetches ; Bush Vetch, two small Tares, Tufted Vetch availing itself of all the supports it can get to scramble up and display its handsome purple flowers, and in a few localities the Everlasting Pea, quite unconcerned as to the comfort of the shrubs beneath its tangle. A more ambitious climber is the Great Bindweed with showy white trumpets ; its relative the Small Convolvulus keeps more to the ground, often edging a gravel path with pinky-white flowers. Their beauty is some compensation for their troublesome habits ; but can anybody put in a good word for Goosegrass, with its rough stems and myriads of small burrs ? Many of the other hedgebank flowers have been mentioned already ; but before taking leave of them a word of praise must be given to the Yellow Toadflax, with its spike of butter and eggs, the more appreciated as it lasts well into the autumn, when most of the floral colours have gone.

Several of the wayside and hedgebank grasses are included in the list of plants that grow in the meadows.

Amongst others, mention should be made of taller grasses like the Tall Oat and Rough Brome Grass, which frequent bushy places, and the Tufted Hair Grass which prefers moister situations. On shady banks there may be found False Brome Grass, and the pretty Melick Grass. Of the sedges the Great Pendulous Sedge is abundant on heavy clay land in the south-eastern part of the county. The Loose-spiked Sedge and Fox Sedge are often found in moist and shady situations.

The foregoing description of plant associations will mark how plants are ready to seize every opportunity to establish themselves. Perhaps their most courageous attempts are to find a home on walls and roofs. Mosses are usually the first to succeed, small grasses and lowly plants like Whitlow Grass, Thyme-leaved Sandwort, Procumbent Pearlwort, Rue-leaved Saxifrage follow on, and with an increase of soil taller brethren, such as Poppy, Nipplewort, and Sowthistle crown the wall. Yellow Stonecrop makes a brave show, and now and again House-leek may be seen on an old roof. In addition to these and their kin, there are plants which have escaped from gardens, such as Wallflower, Snapdragon, Spur Valerian, Yellow Corydalis ; and again creepers like the pretty Ivy-leaved Toadflax, and the close-growing Pellitory.

Walls also provide a resting-place for the spores of ferns, more especially the smaller species, Wall Rue, Black Spleenwort, Ceterach ; Hart's-tongue is also sometimes seen in similar situations, rather small compared with its luxuriant growth in the hedgebanks of the western counties. Polypody occurs on old tree trunks ; Lady Fern, Broad Shield Fern, and Prickly Shield Fern keep on in some of their old habitats ; Male Fern is the most frequently seen. But the race has been sorely harried to supply private gardens. Adder's Tongue may be easily

overlooked on account of its small size, and therein it may find safety. When we look through the numerous records of ferns in Hertfordshire seventy years ago, and think of their rareness at the present time, we feel that every effort should be made to safeguard the survivors.

Let all who love flowers do all they can to preserve our county plants.

APPENDIX

EXERCISES AND OBSERVATIONS ON PLANTS

1. Make lists of flowers which appear :
   (*a*) in early spring.
   (*b*) in later spring.
   (*c*) in midsummer.
   (*d*) in late summer only.
   (*e*) in autumn.
2. Make a list of the wild flowers which you notice during each month of the year. Compare with the lists made by other pupils in your school, and from time to time show your list to your teacher.
3. Try to recognise all the flowers in the district near your school and your home. (*N.B.*—Do not pull them up by the roots, and do not pluck them unnecessarily.)
4. Make as good drawings as you can of some of the different kinds of wild flowers which you commonly meet with.
5. Which flowering plants and trees that you know put out their flowers before their leaves ? What is the cause of this peculiarity ?
6. Select a country lane not far from your home. Make a list of the flowers which you find during the Easter holiday. Do the same for the Summer holiday. Compare the two lists. Carry out the same observations for a wood, a heath, a marsh, a piece of grassland, and make similar comparisons.

7. Study some flowering plants throughout a summer day—visiting them and noticing them carefully at such times as (*a*) early morning, (*b*) about midday, (*c*) late afternoon, (*d*) near dusk. Write an account of any changes that you notice.
8. Notice what kinds of insects visit different species of flowers and under what circumstances. Why do insects visit flowers ?
9. If you have the opportunity go and compare other parts of the county with your own, as regards flowers (*a*) in spring, (*b*) in summer, (*c*) in autumn.
10. Enumerate all the different berries or other wild fruits which you know from your own district. Which of them are poisonous ? Consult with your teacher if necessary.
11. What bushy trees are found in the hedges of the lanes near your home or school ? Make as complete a list as you can. Do the same with the big trees of the lanes you frequently pass along.
12. What kinds of flowers and fruits are produced by the big trees in your district ? Note the difference between those flowers which are large and conspicuous and those which are quite small and not conspicuous.
13. Do you know any trees which produce more than one kind of flower ? Explain why there are different flowers on some trees of the same species.
14. Try to learn about the two different kinds of Primroses which you may find, and the meaning of the difference in structure. Do you know of any other flowers which show similar differences ?
15. If you live in the country or on the edge of a town find out how many kinds of plants you can find growing on the walls, in addition to mosses and lichens. (*N.B.*—Do not despise the mosses and lichens ; they are well worth studying.)
16. What are the differences between the Bluebell and the Harebell ? When and where does each grow ? Describe the differences as fully as you can.
17. When does the Celandine appear ? What provision does it make as to a store of food ? Describe carefully the appearance of the flower and the leaves. What

very common flowers are somewhat similar in appearance to the Celandine ? When do they appear and where do they grow ?

18. Find a specimen of the common Figwort. Compare the structure of the flowers and the arrangement of the leaves on the stem with the Foxglove and the "Monkey Flower."
19. How many kinds of Clover do you know ? Examine a "head" of clover and see how far each little flower of which it is made up is like a vetch flower or pea flower.
20. Which appears first during the spring, Coltsfoot or Dandelion ? How far are they like each other, and in what respects are they different ? What is there peculiar about the order in which the flower and the leaves appear in the case of Coltsfoot ?

PLATE IX.



(*a*) Bee Orchis.



(*b*) Willows by the River Ash.



(*a*) Long-tailed Field or Wood Mouse.



(*b*) Hedgehog.

Section IV.—THE ANIMAL LIFE OF HERTFORDSHIRE

By RICHARD MORSE, F.R.H.S.

CHAPTER XII

ANIMALS OF THE FIELDS AND HEDGEROWS

Timidness of Habit.

Although Hertfordshire is a well-wooded county, and has long been famous for its charming old lanes and high banks and hedgerows, you may often walk for hours across the fields without seeing any other animals than a few grey rabbits, which scamper hurriedly into their hiding-places almost as soon as they have caught a glimpse of you.

And in that timidness of the rabbits you have an excellent illustration of one of the reasons why the animals of our county seem to be so scarce, and why so many people do not even know them by sight or by name.

For generations past, most of the wild animals of this country have been looked upon by man as destructive to his best interests; and so without any hesitation, and often with far too little knowledge of their ways, one after another has been persecuted, or trapped, until scarcely one species remains which has not learned to fear man at the first glimpse, and to flee from his presence to some place of safety.

Indeed, so sharp have their senses of sight and smell

and hearing become, that in the great majority of cases they have crept into hiding long before we have seen them at all, and so we often get the impression that the fields and hedgerows of our county are deserted as we walk along, instead of feeling that our very presence there may be the main reason why so few animals are seen.

And then, too, many of our country's animals have adopted the habit of hiding or sleeping during the day, so that, unless we walk the fields at dusk or in darkness, we are not at all likely to make their acquaintance, although they may be quite plentiful in the fields and hedgerows all around us.

Hedgehogs and Shrews.

The hedgehog, for instance (see Plate X., *b*), is quite a common little animal over most of this county, but it is such a lover of the twilight and the darkness that it is not very often seen. In the early summer months, when the young ones are constantly needing fresh supplies of food, you may frequently catch the parents out on search during the day, but for nearly all the rest of the year it is a timid little creature, and seldom ventures out until the brightness of the day is waning.

It is then that you may hear its short, quick runs through the dead leaves and herbage along the ditch at the foot of the hedgerow. For the hedgehog seldom runs far at a stretch. It shuffles along hurriedly for a few yards, then stops suddenly, as though sniffing or listening for prey, and soon trots along farther in exactly the same way as before, picking up beetles and other insects, slugs, snails, worms, and even sometimes frogs, toads, and mice from amongst the grass and undergrowth where it roams.

Another little insect-eating animal, still more timid and retiring in its habits than the hedgehog, is the common shrew, but it is far more often seen dead than alive. There

is, indeed, a mystery about this shy little creature which no one seems able to solve. In almost every part of the country, during the autumn months, dead shrews are frequently seen lying about the fields and footways, particularly the latter, and seldom can any cause of their death be found.

This has been known to country people for many generations, and is probably the origin of the old superstition, still often heard in many of our remoter villages, that when a shrew crosses a human trackway, it " drops down dead " !

Two other species of shrew are also found in Hertfordshire. The water shrew is a lover of the streamside, and is of frequent occurrence in most parts of the county, but the lesser shrew is quite a rare little creature, and measures barely 2 inches in length. It is, indeed, the very smallest of all our British mammals, and with one single exception is the smallest in the whole of Europe.

Mice and Voles.

Probably the most attractive in appearance, however, of all the animals of our fields and hedgerows are the mice and the voles, of which there are several kinds.

The ordinary house mouse is abundant everywhere, but in the autumn another little animal, often mistaken for the common mouse, frequently finds its way into our houses in search of food and shelter. This is the long-tailed field mouse, or wood mouse, whose reddish-coloured back, white underparts, and very long tail serve at once to distinguish it from the common mouse of our houses (see Plate X., *a*).

The harvest mouse is a handsome little animal, which makes a wonderful globular nest amongst the stalks or ears of the standing corn, but it is now seldom found in the county.

Water mouse, meadow mouse, and short-tailed field mouse are all names which have been given to one of our commonest little animals of the fields, although, strangely enough, it is not really a mouse at all, but the common field vole.

Voles resemble mice very closely in many ways, but usually have shorter tails, shorter legs, stouter bodies, and smaller eyes and ears than the true rats and mice.

The bank vole is very similar to the field vole, but has fur of a chestnut colour, instead of grey, and occurs only in a few localities (*e.g.* Berkhampstead) in the county. It makes its nest of grasses and mosses amongst the low herbage of the fields, and at times is so fierce as to attack small birds, as well as other animals, although it feeds mainly on vegetable matter.

Rabbits, Rats, and Moles.

Rabbits and hares, of course, are familiar animals all over the county, and so is the brown rat. This last, indeed, is one of the most widely distributed animals in the world, and no one seems to know where its proper home really is.

The brown rat is one of the most destructive of our animals. It raids the farmer's corn, beans, and other crops, as well as his poultry-runs and game-preserves, and is not content with eating its fill, but often kills merely for sport, and hoards large quantities of produce in its underground haunts.

It often takes to the water, and is a splendid swimmer, but great care must be taken not to confuse it with the water vole (often called the water-rat), which is a totally different animal (see Chapter XIV.).

The mole, too, is plentiful everywhere, though its "heaps" and runs are far more frequently seen than the animal itself, because the greater part of its life is spent in

seeking its food underground. For the mole is one of the most voracious feeders of all our county's animals. Its principal food consists of earthworms, and if you watch quietly in those places where it abounds, you may sometimes see it break through the surface of the ground in its impetuous chase for its prey.

There are times, too, when the mole will attack and devour much larger creatures than the worm, for mice, small birds, frogs, and even its own species have been known to be eaten by this ever-hungry little animal. It has seldom or never been recorded to touch the toad, for it seems to be aware of the unpleasant fluid which the warty skin of this particular amphibian contains.

Foxes are frequent in the county, but owing to their extreme cunning and fear of man they are seldom seen.

Hertfordshire Bats.

Bats of many kinds come out towards dusk, and may be seen round about the trees and houses at all times from spring to late autumn. The commonest of all is probably the little pipistrelle, but the long-eared bat is found also in most parts, and the great bat, or noctule, may be seen high up around the treetops in rural districts, where it delights in chasing the summer beetles that throng the air at twilight.

This noctule is the largest of all our British bats, and when its wings are fully extended, they usually measure a good deal more than a foot from tip to tip. A peculiar feature of its flight is that it may often be seen to drop suddenly towards the ground with closed wings, and it is supposed that this habit is brought about by the use of its " thumb " in holding its prey, for any such use necessitates at any rate a partial closing of the membranes by which it sustains itself in the air.

Four other bats occur in the county, but they are rare,

or extremely local, in their occurrence. They are the barbastelle, the lesser horseshoe, the serotine, and the reddish grey.

The Scarcity of Reptiles.

Reptiles, on the whole, are scarce, and except perhaps for the common lizard, are seldom seen. This interesting little creature frequents hedgebanks and pastures, and is a familiar dweller in such places as Royston Heath and Berkhampstead Common.

The slow-worm, or blindworm (see Plate XI., *d*), really a lizard without legs, is found in most districts, but the grass snake and the adder are rare, and this last will probably soon become extinct, if it is not so already. It is the only one of our reptiles which need be feared, and its poisonous bite makes it universally disliked and destroyed.

The Regional Life of Animals.

Although the various animals dealt with in this chapter have been spoken of separately, and with but little relation shown between one and the other, every one who tries to understand the wild life of our Hertfordshire fields and hedgerows will soon discover that, taken all together, these little creatures form a sort of established community amongst themselves, where each species plays its part in maintaining a general harmony.

This harmony, it is true, varies from time to time, and man himself often does a great deal to upset it, but, generally speaking, the field and hedgerow regions of our county contain a well-marked association of animal life. You may, of course, find common shrews by the waterside, or in the woodland, and the field vole may surprise you by turning up in the most varied habitats, but, as a general rule, the animal life of the woodland, or of the waterside,

is of quite a different character from that of the open fields and hedgerows.

Unlike the plants, animals are gifted with the power of rapid movement from place to place, and hence the regions which they favour are not nearly so sharply defined as in the case of vegetation.

The study of all our animals becomes of much greater interest if we try to discover *why* their lives are spent mainly in particular types of habitat. Sometimes it is the nature of the soil or rocks, sometimes the contour of the land, sometimes the climate or weather, quite often the character of the vegetation, and perhaps even a combination of all of these factors, which influences the choice of the animals' home.

The exercises which follow will show many ways in which the animal life of Hertfordshire may be studied by this regional method, and in later chapters will be found further suggestions concerning other natural regions.

EXERCISES ON CHAPTER XII

1. Some rabbits live almost wholly above ground, instead of in burrows, and the gamekeepers are said to distinguish them by the darker fur. Try to find if this is true for your own district. Can you suggest a reason for the darker colour ?
2. Make a list of all the places where rabbits are abundant in your locality, and try to find a reason (or reasons) for their choice.
3. Make similar observations with regard to other animals, *e.g.* moles or bats.
4. Draw (or trace) a large-scale map of your district, and mark on it the favourite haunts of as many animals as you can.
5. Keep definite notes of the animal life of certain hedgerows from year to year, and notice and record how this changes when the hedges are cut down.
6. Watch fields carefully after floods, and record the new

animals that are found there, trying to find the reasons for their coming (usually for some special kind of food).

7. What is the difference between the brown rat and the so-called water-rat ? What is the proper name of the latter animal ?
8. How can you tell a pipistrelle bat from a great bat, and what do you know of their food and habits ?
9. Choose any common field or hedgerow animal in your region, and find an answer to as many as you can of the following questions concerning it : (*a*) What does it eat ? (*b*) When does it eat ? (*c*) Has it any special means of getting its food, and, if so, how does it use them ? (*d*) Does it lay by a store of food-stuffs ? If so, say how, when, and where it does so. (*e*) How does it protect itself from its enemies ? (*f*) Does it make a home, or shelter ? If so, describe it as fully as you can. (*g*) Does it attack other creatures, and, if so, how ? (*h*) In how many ways is it specially fitted to its usual habitat ? (*i*) How does it pass the spring, the summer, the autumn, and the winter ? (*j*) Has it any special seasonal changes in habit or covering ? (*k*) How long does it live ? (*l*) How does it provide for its young ones ? (*m*) Does it feed the young itself, or leave them to their fate ? (*n*) What is the complete story of its life, as far as you can discover it ?
10. Choose a field, a woodland, and a waterside region in your own locality, and show how the animal life of each one is different from the others, giving reasons as far as you are able for the differences observed.
11. Have you any well-marked differences of soil in your district, such as clay, chalk, gravel, sand, etc. ? If so, can you detect any difference in the animal life of such soils ?
12. Keep dates of the first and last appearance each year of squirrels, bats, and other hibernating animals. Can you show exactly how these are influenced by the weather ?

CHAPTER XIII

ANIMALS OF THE WOODS

Different Kinds of Woodland.

Large woods are to be seen in almost every part of Hertfordshire, and, although almost all of these have probably been planted, most of them have been so long established that they are in many cases almost, if not quite, as interesting as truly natural woodlands, which are now rare in this country.

A well-grown woodland is one of the most definite types of natural habitat for plants and animals that it would be possible to find, and in the woods of Hertfordshire we have an excellent opportunity of studying the habits and life-histories of some of the most interesting types of our country's animals.

But, as you will have learned from Section III. of this book, our woodlands are not all of the same kind. Some are composed of evergreen trees, others of deciduous ones, and others again of a mixture of the two.

Even the deciduous woods are often wholly different from one another. Some, especially in the chalky districts in the northern parts of the county, contain little but beech trees, for these are great lovers of the Chalk. Others are mainly composed of alders and willows, and these you will find along the banks of the streams and rivers. But perhaps the most typical Hertfordshire woodland is that which is made up mainly of oaks and ashes, with hazels forming the most prominent feature of the undergrowth.

And here we must observe that in each case the type of the woodland is closely related to the character of the

rocks and soils beneath it. Thus, although there are minor exceptions, the beech woods are mainly confined to the Chalk, the alder-willow woods to the riversides and marshes, and the oak-ash woods to the drier loams, gravels, and clays.

Animals and their Environment.

In exactly the same way, a little close study soon brings to light the interesting fact that the animal life, too, of the main types of our county's woodlands varies according to the character of the vegetation.

Wherever any particular animal is naturally abundant in some special type of region, it can only be so because the prevailing conditions are such as will suit it ; and if these change from time to time, owing to man's interference, or to a marked change in the climate, so the animal life, too, gradually changes. Some creatures die out, or change their place of abode, others may be able to adapt themselves to the new conditions, while others, which were in the minority before, may so flourish as to become the dominant race.

In such a small region as a single county, however, these differences are not always clearly marked, and for a start we must be content with observing some of the more general types as an introduction to more detailed studies.

A Rare Animal.

The animal life of our county has changed considerably within living memory, and such animals as badgers, pine martens, and polecats are now seldom or never seen, although once they were probably quite frequent in many of our woods. Badgers certainly we still have. They have been recorded more than once from such districts as Ashridge, Berkhampstead, and Watford, and not long ago

Mr. W. Bickerton secured an excellent photograph of a truly wild specimen in a wood near the last-named town.

It was an extraordinarily fierce creature, and not only forced its teeth right through the gamekeeper's thick leggings, but bit savagely at sticks and anything else that came within its reach. The favourite haunt of the badger is a wooded hillside, where it spends the greater part of its life in its underground home, coming out only after dusk in search of its prey ; hence it is an animal that is seldom seen and little known.

Rabbits and their Enemies.

Along the borders of many of our drier woodlands, rabbits are abundant, and wherever you find these defenceless little creatures in any quantity, you may generally be certain that their tireless enemies, the stoats and the weasels, are not very far away.

The gamekeeper's gibbet is still to be found in most of our larger woods, and is always an interesting—if not a pleasant—object of study. From it you may usually discover a great deal concerning the animal life of the woodland where it is built, and whether such creatures as stoats, weasels, and hedgehogs are common, for all these, in one way or another, are destructive to game.

Stoats and weasels so closely resemble one another in their general appearance that one is often mistaken for the other, but the stoat is, when fully grown, a much larger animal than its near relative, and always has a conspicuous jet-black tuft of fur at the end of its tail.

The Ways of Stoats and Weasels.

These two fierce little animals are of common occurrence all over the county, and their habits are of a most interesting character. Both of them are extremely wary and clever

hunters, and both make use of the quaint antics known as the " death dance " when in chase of their prey.

You may see one in the grass, apparently at play, leaping, running, tumbling, and rolling in the most extraordinary manner, but yet all the time making its approach nearer and nearer to some unsuspecting small animal or bird, which usually pays the penalty of death for its failure to perceive the fierce little carnivore's intentions.

Stoats and weasels, too, are both fairly expert swimmers and climbers, and are frequently to be seen in trees and hedgerows as well as on the ground. The weasel is an expert nest-hunter, and not only sucks the eggs of the birds, but also carries off their young ; and, like the stoat, it will often plunge boldly into a stream or river in the pursuit of such creatures as rats or voles, which form a large part of its prey.

The stoat has the strange and interesting habit of changing the colour of its fur from reddish brown to almost pure white in the winter months, but this seasonal change, although common in the north of our island, is rare in the south, and only rarely have white stoats been observed in Hertfordshire.

The Homes of Squirrels and Dormice.

The most attractive animals of our county's woodlands, however, are the squirrels and dormice, the former being quite common, but the latter rare, in the county as a whole.

Until recent times, only our native red squirrel was known in the wild state in this country, but the grey American squirrel, which has been introduced into some of the London parks and similar places, is now gradually spreading over Hertfordshire, and may be seen in our woods even as far north as Hexton and other places on the Bedfordshire border. It is a more clumsily built little

creature than our own native species, and not nearly so attractive in appearance, but, being of much bolder habit, it may succeed in the long run in driving out our native squirrel.

The squirrel's food consists chiefly of hazel nuts, beech nuts, acorns, and the bark and shoots of trees, but it is particularly fond of the rich, oily nuts, and wherever you find a woodland with a plentiful supply of these dainties, you may usually expect at least one pair of squirrels to make their home.

For these little animals seldom or never wander very far. Like the common cat of our homesteads, they develop a peculiar attachment to certain small areas, and when once you have discovered their home, a careful search at future times will usually result in your finding either the squirrels themselves, or traces of their activities round about.

The dormouse in many respects closely resembles the squirrel, but it is not at all of general occurrence throughout the county. It is an exceedingly shy and retiring little animal, and, owing to its scarcity, and also to its nocturnal habits, it is only on rare occasions that its unusually pretty ways can be watched.

It feeds mainly upon nuts, acorns, and haws, occasionally taking a little of the farmer's corn, and, like its larger relative, always lays up a store of these and similar dainties for the winter.

In fact it is by these winter stores, which are carefully hoarded in a globular nest in woodland or hedgerow, that the presence of the dormouse is usually first detected in a district. On warm days, even in the depth of winter, the little sleeper occasionally awakens, and sometimes stirs abroad in the vicinity of its cosy little home, feeding then upon the provisions which its instinct has taught it will be needed as soon as bodily activities reawaken.

Environment, Structure, and Habit.

The animals referred to in this chapter are not, of course, the only inhabitants of our Hertfordshire woodlands, but they are those which are most characteristic of such haunts. In almost every district, however, there may be found minor variations.

In woodlands, for example, which are frequently cut down, and where the undergrowth is cleared away, the more shy creatures, such as the dormouse, are scarcely likely to be found; and in open woodlands of this type, there is often to be observed a kind of migration of animals whose usual home is in the fields and hedgerows.

And similarly, in those alder-willow woods which lie along some of our watercourses, it is almost impossible to separate one type of habitat from another. The woodland creatures creep down to the watersides, and the water-dwellers often explore the depths of the woods.

The structure and appearance of an animal often vary quite surprisingly in relation to its accustomed haunts. The stoat of Hertfordshire, for example, can be distinguished from a member of the same species which has spent its life in one of our more northern counties, and the badgers of North Britain are not absolutely identical with those of the south.

Some Strange Variations.

And somewhat similar variations may be noted even in so small a region as our own county. A frog that strays from a gravelly stream to the dark shades of a wood may change from yellow to brown; and an animal or a bird, or an insect which flourishes in one district, may be wholly absent from another not far away.

The fierce-looking stag-beetle, for instance (see Plate XI., *e*), is practically unknown in the northern parts of Hertfordshire, whilst in the neighbouring county of Buck-

inghamshire it occurs frequently, and so has often been recorded in those parts of our own county which lie along its borders.

There are, indeed, scores of problems of this kind which are worth careful study. There is no single district which has yet been systematically explored and the results recorded, although at Letchworth Garden City a vast amount of excellent work is being done, which is helping us to understand the wonderful relationships that exist between one type of living creature and another.

EXERCISES ON CHAPTER XIII

1. How many distinct types of woodland occur in (*a*) your own district, and (*b*) the whole county? How can you distinguish one from another ?
2. Make a list of all the animal life you can observe in (*a*) an oak-ash wood, (*b*) a beech wood, and (*c*) an alder-willow wood. What differences do you notice, and how can you account for them ?
3. Make a list of all the creatures which you can name on a gamekeeper's gibbet, and say, if you can, (*a*) why they visited that region, and (*b*) why the gamekeeper destroyed them.
4. Which are the commonest wild animals of your own locality ? Can you account for their abundance ? Are neighbouring districts similar in this respect ? If not, can you suggest any reasons for the difference ?
5. What do you know of the habits of stoats and weasels ? In what ways do they resemble, and in what ways do they differ from, one another ?
6. How many kinds of squirrels occur in Hertfordshire ? What are their characteristics ? How many have been found in your own region ?
7. Draw a large-scale map of your own district, and mark all the woodlands boldly upon it. Try to find out the type of woodland in each case, and also the principal animals which live there. Can you account for the differences which you notice ?

8. What do you know about the dormouse? Give an account of its habits and life-history, and say in what parts of your own locality it may be found.
9. Choose any woodland animal of your own region, and try to answer the questions concerning it which are given under Exercise 9 at the end of the preceding chapter.
10. Say what you can of the change which animals undergo when their environment is altered, and give examples, if possible, from observations in your own district.
11. What do you know about the badger? Has it ever been found in your neighbourhood? In what parts of the county would you expect to find it, and why?
12. Compare the animal life of our fields and hedgerows with that of our woodlands, and give as many reasons as you can for the differences you mention.

CHAPTER XIV

ANIMALS OF THE WATERSIDES AND MARSHES

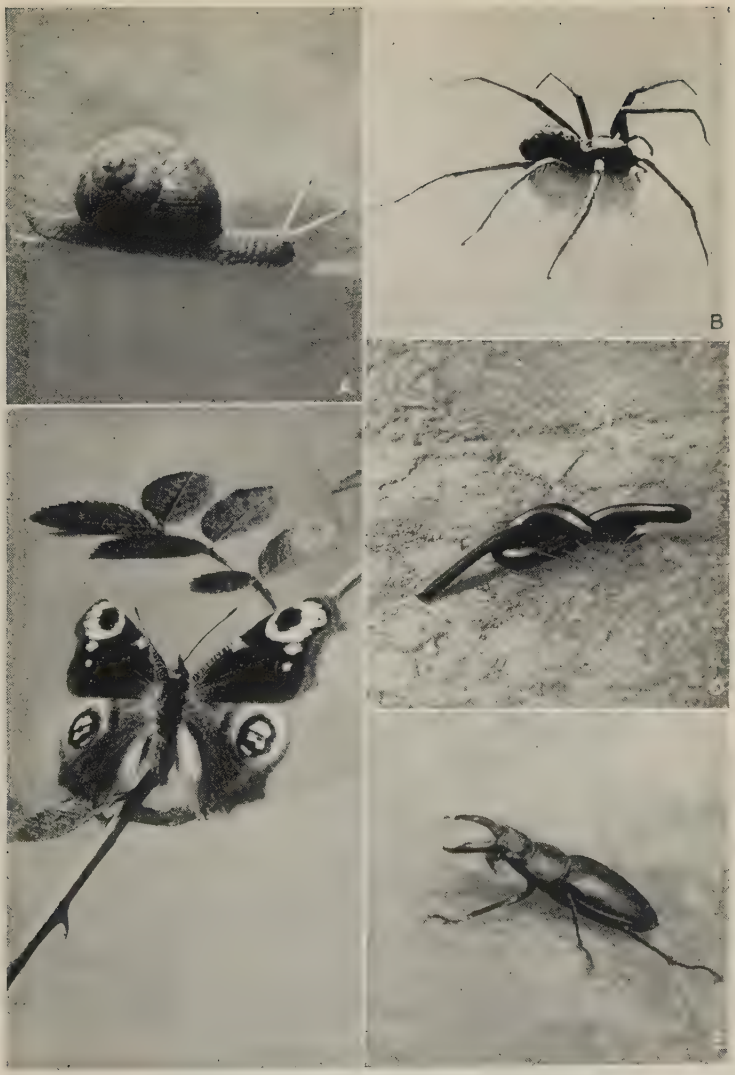
Natural Habitats.

Just as there are many animals which are usually associated with the fields and hedgerows, and with the various types of woodland to be found in this county, so there are others which prefer watersides and damp places generally, and in this chapter a short account of some of the more interesting of these will be given.

It must be urged here, however, that none of these natural groupings of our county's animals will be clearly understood unless they are studied in relation to the matters dealt with in the other parts of this book.

In the study of any of the wild creatures of our countryside, it is of the utmost importance to view them not

PLATE XI.



(*a*) Roman Snail
(*b*) Shade-loving Spider.
(*c*) Peacock Butterfly.
(*d*) Slow-worm.
(*e*) Stag-beetle, Male.



(*a*) Carp. (*b*) Great Warty Newt, Male. (*c*) Otter.

merely as isolated individuals, but also as essential parts of a great scheme. Something must be known in the present case, for example, of the type of waterside where the creatures live, if the history of their presence there is to be understood.

How did this particular district come to be a waterside at all? What is the nature of the rocks that lie beneath? What part has the weather played in shaping the contours of the neighbourhood? What is the relation which all those factors bear to the plants and the trees that cover the ground, and how have they all contributed to the making of an environment which shall supply the needs of the animals we find here to-day? These are some of the questions to which we must try to find answers if we would understand the history of even one single animal that haunts our streams and marshes at the present time.

Every animal seeks in one way or another to provide itself with food and shelter, and those which you find regularly inhabiting our watersides to-day have usually settled down there because in some way this particular kind of home is the one which supplies all they need with the least amount of effort on their part.

The Water Vole.

Probably the most frequently seen of all our waterside dwellers is the common water vole, or water "rat." The latter name is unfortunately the one more frequently used, in spite of the fact that the animal to which it is applied is not a rat at all, but a perfectly harmless little creature, with habits and structure quite different from those of the common brown rat referred to in Chapter XII.

The water vole is widely distributed throughout the county, and there is probably hardly a single stream where its interesting habits may not be watched. Selecting a

suitable part of the bank, it excavates for itself a place of shelter, to which it may retire when danger threatens, and where the young ones are born in the early summer months.

No animal could be more at home in the water than this. It swims with the greatest ease, and dives hurriedly beneath the surface at the least suggestion of alarm, always emerging, owing to its peculiarly adapted coat, none the worse for its wetting.

The water vole is probably a vegetarian, its food consisting mainly of the stems and leaves of plants which grow by the riverside. It appears to be dainty in its tastes, and often discards almost as much as it eats, taking only the more tender parts of the plants, and leaving the fibrous tissues scattered untidily around its home.

Two Common Errors.

Concerning the feeding habits of this very pretty little animal, two wholly erroneous beliefs are still handed down in various parts of the county, and lead sometimes to a persecution which is altogether undeserved.

The bones of fishes are sometimes to be found around the excavations made by this animal, and the vole itself is often blamed. In every case, however, where such remains are found, it is likely that a kingfisher which has been using the burrow is responsible for the bones which are discovered outside.

A further charge of killing other creatures is also levelled against the water vole and, in evidence of this, attention is drawn to numbers of mutilated and partially devoured frogs, which may often be found along the banks of our streams in the early spring.

No less than thirty such specimens were counted on a March morning, for instance, a few years ago, along the banks of the Stort between Bishop's Stortford and Saw-

bridgeworth, and the water voles which abound along that river were by many local folk blamed for the deed.

The explanation lies in the fact that the brown rat's occasional fondness for the water leads it to be mistaken for its vegetarian relative, and so many of its crimes are poured upon the head of one of the most inoffensive of all our country's animals.

The Water Shrew.

Another interesting little inhabitant of our Hertfordshire streamsides is the water shrew, an animal so closely resembling the common shrew referred to in Chapter XII. as to be quite frequently mistaken for it. It does not, however, confine its activities to the banks of brooks and rivers, for it may often be seen far from any signs of water, but its whole structure is so admirably adapted for swimming and diving as to leave little doubt about its natural home.

It is probably far more common in the county than is usually supposed, but being of shy and retiring habits is seldom noticed unless specially sought. In the water it is peculiarly attractive. It swims very well, but always with a kind of zig-zag movement, and its whole body when under water glimmers with countless air bubbles, which, under such conditions, always deck its short and velvet-like coat.

The Otter.

A far rarer animal is the otter (see Plate XII., *c*), and it is scarcely likely ever to be common again in any of our streams, for, owing to its insatiable appetite for fish, it is kept severely in check by those who have any interest in the angling pursuit.

Old Izaak Walton, whose quaint little book called *The Compleat Angler* was published as far back as 1653, used

often to spend quiet hours fishing in our river Lea, and he knew the habits of this bloodthirsty little animal quite well. "The otter devours much fish," he wrote, "and kills and spoils more than he eats." And that, of course, is just what the otter does, in the same way that the brown rat and the fox will commit similar havoc amongst the fowls and other poultry of the farmyard.

When the trout-hatchery at Radwell was in the fulness of its activity, an otter was occasionally to be seen in that neighbourhood, attracted, no doubt, by the rich abundance of its favourite food, and a few still appear at intervals in the very stream which Izaak Walton loved; but it is nowhere in this county so frequently seen as it is in the neighbouring shire of Buckingham, where a score or more have sometimes been killed in a single year by the otter-hounds of that county.

Amphibians.

Amongst the lower types of animal life which frequent our watersides and marshes, mention must be made of those creatures known as amphibians. These animals are hatched from eggs in water and pass through a tadpole stage in which they breathe by means of gills. Afterwards they can breathe by means of lungs.

So far as Hertfordshire is concerned, the four commonest members of this group are the frog, the toad, the common newt, and the crested newt (see Plate XII., *b*), all of which are more or less frequent in every part of the county. They are not, however, wholly waterside dwellers, but since in each case their early life is spent in the water, they invariably repair to such places for egg-laying in the first months of the spring.

The only other of our county's amphibians is the natterjack toad, but it is of extremely rare occurrence. It has, indeed, been recorded for only seventeen English counties,

and though it has once or twice been observed near Berkhampstead, it must be reckoned amongst the very scarcest of our Hertfordshire animals. It is much more active in its habits than the common toad, and although seldom or never seen to hop, it runs with considerable speed, and appears thus in striking contrast to its slow-moving and commoner relative.

EXERCISES ON CHAPTER XIV

1. Choose a common animal of (*a*) the fields, (*b*) the woods, and (*c*) the watersides, and show in each case how they are specially fitted for the life they lead.
2. Say what you can of the habits of the common water vole, and show how the physical features, the rocks, the weather, and the vegetation have all had an influence in deciding its presence in your region.
3. On a large-scale map of your own district, show in different colours (*a*) the field regions, (*b*) the woodland regions, and (*c*) the waterside regions. Compare the types of animal life which are present in each case.
4. How many kinds of shrews are to be found (*a*) in Hertfordshire, and (*b*) in your own region? How can you tell one from another?
5. What do you know of the habits of the otter, and in what parts of the county would you expect to find it?
6. Why are frogs, toads, and newts called amphibians? How many kinds of each of these are to be found (*a*) in Hertfordshire, and (*b*) in your own region?
7. Choose any animal of the waterside in your district, and try to answer all the questions concerning it which are set out in Exercise 9 of Chapter XII.
8. Note very carefully the colour of frogs found in various parts of your locality. Can you account for the differences you notice?
9. Has a stream or other watercourse ever become wholly dry in your region? If so, what change have you noticed in the animal life round about?

APPENDIX TO SECTION IV

A SHORT SUMMARY OF SOME OF THE COMMONER AND MORE INTERESTING FORMS FOUND IN THE COUNTY.

Class A.—ANIMALS WITH BACKBONES.

Group I.—MAMMALS.

1. *Bats.*—Barbastelle (rare). Common, or Pipistrelle. Great, or Noctule. Lesser Horseshoe (rare). Long-eared. Natterer's, or Reddish-grey (rare). Serotine (rare).

2. *Insect-Eaters.*—Hedgehog. Mole. Common Shrew. Lesser Shrew (rare). Water Shrew.

3. *Flesh-Eaters.*—Badger (rare). Fox. Otter (rare). Pine Marten (very rare—probably now extinct). Polecat (very rare—perhaps now extinct). Stoat. Weasel.

4. *Gnawing Animals.*—Dormouse. Common Squirrel. Grey Squirrel (an American species recently introduced). Harvest Mouse (rare). House Mouse. Wood Mouse. Brown Rat. Bank Vole (rare). Field Vole. Water Vole. Hare. Rabbit.

5. *Hoofed Animals.*—The Red Deer and Fallow Deer are not truly wild in the county, but are to be seen in some of the larger parks.

Group II.—BIRDS.

(A separate account of the Birds of the county will be found in Section V. of this book.)

Group III.—REPTILES.

Adder, or Viper (rare). Common Lizard. Slow-worm, or Blindworm. Grass, or Ringed Snake (rare).

Group IV.—AMPHIBIANS.

Common Frog. Common Toad. Natterjack Toad (rare). Common Newt. Great Crested Newt.

Group V.—FISHES.

(A photograph of one of the fishes, the Carp, is shown on Plate XII., *a*.)

Class B.—ANIMALS WITHOUT BACKBONES.

Group I.—SNAILS, etc.

(A photograph of one of the snails, the Roman Snail, is shown on Plate XI., *a*.)

Group II.—INSECTS, etc.

1. *Beetles*.—(See Plate XI., *e*.)
2. *Bees*, etc.
3. *Moths*.
4. *Butterflies*.—(See Plate XI., *c*.)
5. *Flies*.
6. *Miscellaneous*.—(See Plate XI., *b*.)

Group III.—WORMS, AND OTHER LOWLY ANIMALS.

Section V.—BIRD LIFE IN HERTFORDSHIRE

By W. BICKERTON, F.Z.S.

CHAPTER XV

A GENERAL VIEW

In Section IV. you have read about the wild animals; we must now consider more particularly the birds of our county. In one way, these possess a great advantage over the trees and flowers, especially in that they can travel over long distances with great ease. Some of the birds, for example, make the long journey from Cape Colony to Hertfordshire every spring-time, and back again every autumn, thus travelling something like 12,000 miles a year. Therefore they can pass very readily from county to county, or from one part of Europe to another. And yet it is found that the birds are definitely related to the surface features of the land in which they live; that the birds of the open downs, for instance, are different from those of the woodland districts, and that those of the river valleys are not those which you find among the lanes of the countryside. In other words, the birds are related to the physical conditions which prevail in the various portions of the county.

It will be well, first of all, to take a broad view and to see the relations which obtain between the bird life of our county as a whole, and (*a*) the birds of the whole of the British Isles, and (*b*) the birds of those counties which surround our own.

In a list of British birds published in 1915, it was shown that 474 different kinds or species of birds have been identified in our islands. Glancing next at the lists of birds observed in our own and in the neighbouring counties, we obtain the following summary :

Bedfordshire (1904)	214 species.
Buckinghamshire (1905)	208 ,,
Cambridgeshire (1904)	234 ,,
Essex (1903)	287 ,,
Hertfordshire (1902)	210 ,,
Middlesex (1869)	225 ,,

The dates given in this table indicate the years in which the various lists were prepared, and since 1902 sixteen additional kinds have been recorded for our own county, making an up-to-date total of 226. It should be noted that it is over fifty years since the list of Middlesex birds was prepared, and that the Middlesex of those days included a large portion of what has now become the County of London.

Allowing for these considerations, it is remarkable that, leaving out Essex, the numbers of birds identified in our own county and in the four others vary so little. By way of contrast, you will notice that the Essex list of 1903 includes 77 species more than the Hertfordshire list of 1902. Why should there be so large a difference ? Essex is more than twice as large as Hertfordshire and has a seacoast deeply indented by lengthy arms of the sea running far inland. It has a more extensive river system than Hertfordshire ; and near the rivers, their estuaries, and the coast-line, there are hundreds of acres of marshlands. These are all very attractive to birds, and especially to the sea-birds and wading-birds. So that we see how the wild life of a county is naturally related to the surface conditions.

How the Birds vary during the Year.

All boys and girls know that the bird population is not the same all through the year. Even the birds about the house and garden vary with the seasons. The birds that are with us all the year round we call Residents; those that come to us for the summer only are Summer Visitors or Summer Migrants. When the summer visitors have departed to the lands of the sunny south, their places are taken to some extent by Winter Visitors or Winter Migrants —birds which come here to escape the severe winters in the far north. The feltie or fieldfare, the redwing, the snow bunting, the grey or Royston crow (the only British bird that has received a Hertfordshire name), and the woodcock are such birds; but as they do not sing and as they are not so easily watched, they are not nearly so well known.

Closer observation still has shown that certain species of birds, which come to England in spring along with the summer migrants, do not stay with us, but go farther north for their summer season; and that when they return in the autumn they press farther south for their winter quarters. Such birds simply *pass through* Hertfordshire twice a year on their spring and autumn migrations. We call them Passing Migrants, or Birds of Passage. The ring ouzel, the dotterel, and the common sandpiper are such birds so far as Hertfordshire is concerned; though all these species stay farther north and nest in England.

Finally, there are several birds that only visit our county now and again—perhaps only once in ten years or so. Indeed, there are on our list about forty species which have only been seen once, and about twenty others which have only been known to visit Hertfordshire twice. Sometimes only single birds are seen, *e.g.* the black redstart, the cormorant, and the storm petrel; at other times small flocks come together, like the sand grouse and the cross-

bills. Many of them come over from the countries of Europe—the sand grouse just mentioned is really a bird of Central Asia—though now and then a stray bird has been known to fly right across the Atlantic from America to England. Many of these wanderers are, unfortunately, shot as trophies. Many of them, too, are sea and shore birds, which during the gales of winter are blown right across country, sometimes for hundreds of miles. Many of these also meet an unkindly fate, perishing either of exhaustion or starvation, or being shot. All the birds which visit us only at irregular intervals—and they may come at any time of the year—are known as Casual or Accidental Visitors, and they make up the last of the five divisions into which *all the birds of the British Isles or of any district within the British Isles may be arranged.* We may now give a table showing our birds from another point of view.

	British Isles.	Herts.
Resident Birds . . .	141	67
Summer Visitors . . .	47	30
Winter Visitors . . .	46	17
Birds of Passage . . .	30	12
Casual or Accidental Visitors . .	210	100
	474	226

CHAPTER XVI

THE DETAILS OF THE PICTURE

We must now examine the different physical features which make up the whole area of Hertfordshire, and

connect with each of these the birds which there find suitable conditions of life—a natural " habitat " or " environment," as it is called.

The following variations of surface, in which we should expect to find more or less well-marked differences in the birds which are attracted to each, should be readily understood from earlier Sections of this book :

1. The chalk hills and open downs which stretch across the northern part of the county—the Chiltern Hills.
2. The valleys which contain our rivers and streams, together with the stretches of marshland and water meadow that lie close to them. Naturally connected with these are the large sheets of open water that occur at Tring and Elstree, and which attract so many of the larger water-fowl such as ducks, seabirds, waders, and divers.
3. The unenclosed commons and heathlands.
4. The stretches of woodland and of parkland, with smaller coppices and clumps of trees, that are so common almost everywhere outside the Chalk area.
5. The more intimate haunts of man—his houses, gardens, and orchards ; his farmsteads and cultivated fields ; and the villages and towns which he has built.

These divisions blend quietly the one into the other, and there may be a connecting belt between any two of them, exhibiting qualities of each, and in which birds from both may be found living together. Therefore you must not conclude, if we name certain birds as belonging to one of our five types of habitat, that some of them are not to be found also in other and different areas.

The Birds around our Homes.

What an interesting group of birds those are which, by attaching themselves to the surroundings of man, seem to have lost some of their native wildness! Take, for instance, the House Sparrow, who builds his slovenly yet capacious nest in a hole in the wall, beneath the eaves, or even in the top of the rainpipe. Noisy, playful, pugnacious, always in evidence, frequently in mischief, he brings life and gaiety to the dreariest of streets as he does also to the quiet country places. The house sparrow, despite his dull plumage and his rough-and-tumble manners, comes of a good family. He is really a finch—a near relation of the chaffinch, the goldfinch, the bullfinch—all birds of fine feathers. From their point of view, no doubt, he has come down in the world; yet he has the finch build, many of the finch ways, and the finch beak—a very strong one specially fitted for opening and crushing seeds. For all the finches are, in the main, seed-eaters; hard-billed birds as against the soft-billed birds which mostly feed on insects.

Almost as common a house-bird is the Starling, richly coloured in glowing purple and brown, and daintily speckled when full grown. These birds, too, protect their nests and young by building in holes, either about the houses or in trees. The starling has one chief distinction: he is the best bird mimic we have. He can "take off" and use as his own the notes of almost any bird he hears, and turn them all into a delicious jumble of bird music that is unique. And the autumn months bring us no more wonderful sight than the myriads of starlings, flocking together in the evening before they settle down to roost in the reed-beds or the woods.

The Jackdaw is frequently a house-bird and is fond of carrying his bundle of nesting sticks down into the chimney

—sometimes even at the risk of being smoked out. How the young birds escape the perils of suffocation is a mystery. The jackdaw is a crow, *i.e.* he is a member of the crow family—the family of birds which is said to stand at the head of all bird families in brain power. Certainly the jackdaw is a knowing bird, and like the rest of his family he is fond of hearing himself talk.

Next on our list comes the trim and graceful Pied Wagtail (see Plate XIII., *c*), a handsomely coloured bird, though only in black and white and grey, thoroughly at home running up the roof-slope or along the roof-ridge, "chissicking" merrily to his mate as he trips along. He is one of the most active little birds we have—a habit shown by his name of *wag*tail; and he can scarcely ever find time to *walk* but must always be "on the run." He is fond of nesting in the ivy on the wall or in one of the stacks in the farmyard. And round the farmyard pond or on the garden lawn he fares sumptuously on the abundant insect life he finds, for he is an insect-feeder and therefore a valuable bird about the house and garden where insect pests abound.

Two members of the swallow tribe next claim our attention—the House Martin, and the Swallow proper—the typical bird of spring. Both spend most of their time on the wing, and very little of it at rest, until their first broods are hatched out and able to fend for themselves. Ceaselessly they fly to and fro in pursuit of each other, or of the small flies on which they feed, all the while expressing their feelings of the joy of life in a constant twitter and song. Because they are so much alike, in appearance, in manner of flight, and in general habit, many people are unable to distinguish them as separate species. Here are four points of difference: (1) the dark steel-blue plumage of the swallow is continued all down his back right to the tail, the martin has a large conspicuous patch of white feathers on the lower back just in front of the tail;

(2) the throat of the swallow is of a rich chestnut colour, with a darker band below this, that of the martin is white ; (3) the tail of the swallow is longer and more pointed than that of the martin ; (4) the swallow always makes his nest *inside* a building—a barn or outhouse for preference—the martin always makes his under the eaves, and therefore *outside* the house. Both are skilful builders, and work with unusual material, namely, wet mud, which is both bricks and mortar to them ; as their beaks, too, have to serve both as shovel and trowel. The swallow frequently supports his nest on a beam underneath, but the martin has a more difficult task, as he must usually attach his nest to the front face of the house wall, and the only support is its own " strength " ; he is certainly one of the most skilful house-builders we have.

Another " bird of the air," and also of the house, is the screaming Swift. He closely resembles both swallow and martin ; so much so, that all three are frequently referred to as " the swallows." The swift, however, belongs to an entirely different family of birds—he goes with the kingfisher, the woodpeckers, and the nightjar, because in so many points the structure of his body resembles theirs. And in plumage he is dark coloured both above and underneath : the under feathers of both swallow and martin are white.

But in one way the swift is ahead of all British birds, and that is in his matchless powers of flight, a quality in which he has no superior in all the realm of birdland. More wonderful even than the swiftness of his flight, from which he takes his name, are his powers of endurance. He is almost always aloft on crescent wings : you never see him alight on the ground, or perch on a building or a tree. Indeed he would find it difficult either to perch or to walk, for the simple reason that, practically speaking, he has no legs ; he has only his feet, with the claws of which he can

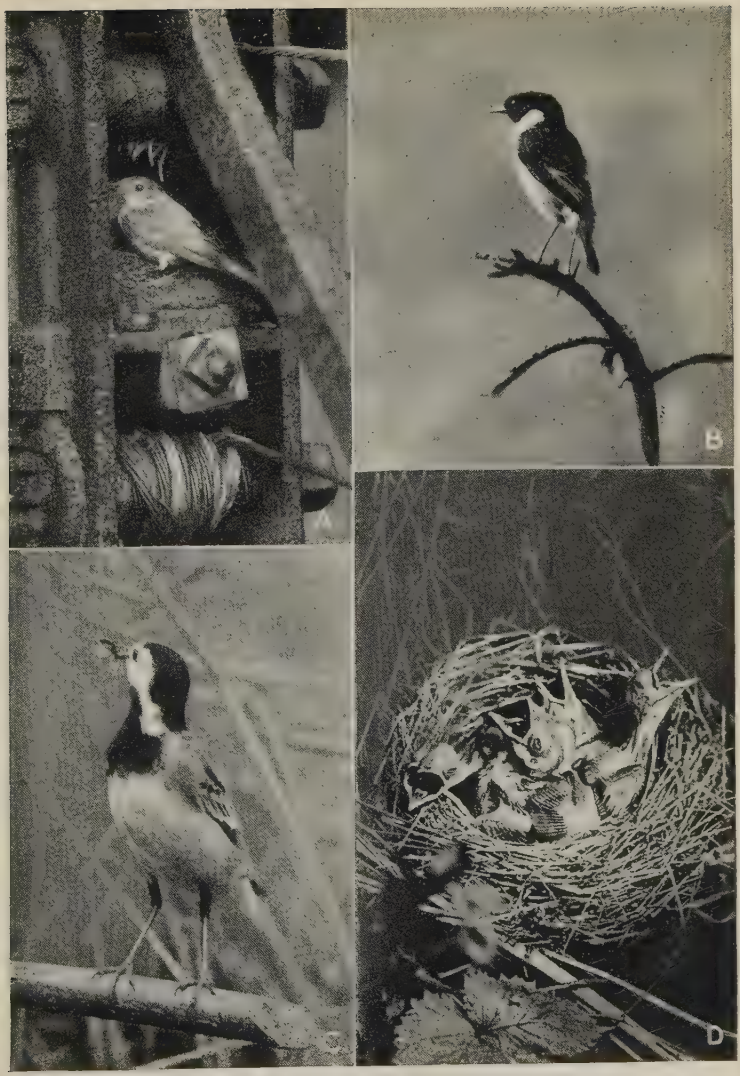
cling—sometimes even to an upright wall. It is said that he can remain in the air for eighteen hours a day, and that he rarely leaves it save when he shoots up to his nesting or roosting quarters under the eaves. He gathers his insect food as he rushes along in mad career. Does he quench his thirst by taking sips of water from river or lake as he flies low over the surface? And does he gather the material of which he makes his nest also while he flies quickly through space? In some respects swifts are mystery birds still. I suggest that you watch them very carefully next year, and try to learn some of their secrets.

The last of the birds on our home list is one that is very seldom seen and not very frequently heard. He is one of the mystery birds of the night, as the swift is of the day. We refer to the White Owl, Barn Owl, or Screech Owl as he is called; though with regard to his colour name, it is only the under feathers that are white. He is the owl with the oval face; he prefers the darkest and most remote corner of the barn or hayloft, and there he mopes out his days, eats up his mice, and brings up his queer-looking baby owlets. He is equally fond of the church tower as a home, and he shuns all society whether of his own kind or of strangers:

> "Save that, from yonder ivy-mantled tower,
> The moping owl doth to the moon complain
> Of those who, wand'ring near her secret bower,
> Molest her ancient solitary reign."

Nevertheless, the owl is a good friend to man, in the number of rats and mice he destroys in favour of the farmer and his crops.

And the owl completes our list of the eight birds that have their haunts in our houses and outbuildings—birds which have made their homes, as it were, within the close ring of human association. They belong to seven different



(*a*) Spotted Fly-catcher at Nest in Iron Gate.
(*b*) Male Stonechat.
(*c*) Pied Wagtail near Nest in Stackyard.
(*d*) Young Blackbirds sheltering from the Heat



(a) Tufted Duck on Nest. (b) Male Blackbird at Nest
(c) Female Peewit at Nest.

groups of birds: the Finches, Starlings, Crows, Wagtails, Swallows, Woodpeckers, and Owls. Five of them are residents, three are summer visitors. Seven of the eight are active by day; one is active by night. They include the most go-ahead of all our birds, the best mimic, one of the birds of high brain power, the most skilful plasterer, and one a wonderful master of flight. Four of them are insect-eaters, one a seed-eater, one a bird of prey, and two indulge in a mixed diet. Did I not say they were an interesting group?

CHAPTER XVII

BIRDS OF GARDEN, ORCHARD, AND FIELD

It is a natural step from the birds of the house to those of its surroundings—the garden, the orchard, and the field—for these also are homely birds and have entered just as closely into our everyday life. They, too, are birds we have known from childhood; they have endeared themselves to us by their confidences, their companionship, their winning ways. No bird has so established a hold on childhood's affections and retained it when childhood's days are past as has the Robin. His cheery ways; his firm reliance on our kindly intentions; his engaging and sprightly manner; the relief he brings to the gloom of a winter's day by his presence at the window, by his splendid blaze of colour, and his cheerful if somewhat plaintive song; his confident appeals for food; his constant attendance on the gardener: these have all combined to inspire an unfailing affection for him, and to justify the poet's reference to him as "the darling of children and men." And the traditions that have gathered about him, from the

"Babes in the Wood" myth onwards, have almost surrounded him with a savour of sanctity.

Let us look for a moment at some of the plain facts of his existence. He is a distant relative of the thrushes, and he often shows this kinship by striking the thrush attitude of inquiry when on the ground—especially when awaiting the result of the gardener's efforts. Like the thrushes, too, he is devoted to worms as a staple article of diet, though, as with them, seeds and berries will serve his turn in winter. Young robins, like young thrushes, have speckled or mottled breast feathers during their first few months, but, unlike the thrushes, they do not retain this dress after their first moult, as they then assume the bright red breast feathers which have counted for so much in the robin's appeal to our sympathies. Adult robins, like adult thrushes, have the same olive-brown colour on their upper plumage; both are excellent songsters, and they sing when most other birds are silent.

A very strong quality in the redbreast's character is his pugnacity. Each pair mark out for themselves a little estate, it may be in the garden, the field, or about the farmstead; and to hold their own against all other robins they will fight desperately. "One bush will not harbour two robins," goes the old saying.

The robin's nest is surely known to all. It is bulky, and though rough and untidy on the outside, it is warmly and cosily lined. While very generally on or near the ground, and placed beneath some kind of shelter, it is often found in the most eccentric situations: an old hat, an old boot, and almost any old discarded "tin" is readily accepted.

Three closely related members of the Thrush family are usually to be found about the garden and the orchard; they are the Songthrush, the Blackbird, and the Missel Thrush or Stormcock, the last-named being the largest of

the three. Whenever possible, it is illuminating to study birds in family groups, because by so doing you not only trace the family characteristics running through the group, but you can also by comparison notice the qualities or ways in which each member has become separate, *i.e.* by developing features and habits all his own.

Apart from casual visitors there are six kinds of thrushes in England, all of about the same size and build, but differing in some very striking features. The three we have mentioned are with us all through the year; two others, the fieldfare and the redwing, come to us for the winter only; while the sixth, the ring ouzel or mountain blackbird, nests on the hills farther north. He is the only one of the six that avoids woodland districts, and in Hertfordshire he is only a passing migrant.

Comparing our three thrushes of garden and orchard, the songthrush and the missel thrush are almost alike in colour, and both have speckled breast feathers: the blackbird, as his name implies, is quite different in appearance (see Plate XIV., *b*). All three, as also the ring ouzel, make nests of a similar kind, and use similar materials; that of the last-named is always on the ground, as the blackbird's frequently, and the songthrush's occasionally, may also be. Their eggs too have a general family resemblance, though each species is different in colour and markings. In building their nests all four cement the main fabric together with an inner coating of mud, but, while the songthrush stops at that stage, the other three place a soft lining of dried grass inside the mud lining.

Our three resident thrushes are first-rate songsters, and all commence singing early in the year, the blackbird a little later than the others. Though the quality and the range of their notes and phrasing are different, each has the habit, most marked in the songthrush, of repeating a note or a phrase over and over again. And while song-

thrush and blackbird are about the grounds all through the year and will nest freely in their trees and shrubs, the missel thrush favours the orchard only in spring and early summer, and in nesting he prefers a more elevated position, such as a fork well up in the apple tree. He is, too, a very bold bird in defence of his young; and will readily swoop down at any intruder who ventures near.

And what would the garden be without the lively little tits, flitting about from tree to tree, always active, always excited, always letting you know they are there? And when the festive board is set, or the tempting coconut hung for them in winter, what a scolding and threatening of all who may come to share the feast! And how amusing to watch their endless antics; swinging at the end of the tiniest twig; now hanging head downwards; and now clinging woodpecker-like to the trunk of the tree as their keen little eyes search every crevice of the bark for insect food. Although it has to be admitted that, later on, they do some damage to the pears and the peas, it should also be remembered that they destroy vast numbers of those insect pests which, if allowed to multiply unchecked, would make the growth of fruit and vegetables impossible. A pair of great tits, for instance, during the twenty days they were occupied in rearing their young, "were responsible for the destruction of between 7000 and 8000 insects, chiefly caterpillars"!

There are six species of tits known in Britain. They are all residents, staying to share with us the hardships of winter; they are the Blue Tit, the Great Tit, the Cole Tit, the Marsh Tit, the Long-tailed Tit, and the Crested Tit, though the last-named keeps to the dense fir woods of Scotland; he has never been seen in Hertfordshire.

The blue and great tits are birds of the garden; the cole and marsh tits are mainly woodland birds, though you may sometimes see the former in the orchard. The long-

tailed tit mostly roams about the woods in winter, though he likes to nest in the woodside hedge, or in the gorse or blackthorn on the common.

All the tits are shapely little birds, active and light-footed in their movements, and just as quick and clever with their " parts of speech." I do not know of any bird, large or small, unless it be the starling, which uses so many different notes of call. They are so variable and so unexpected that it is not easy to say to which bird a particular note belongs, unless you have actually seen the singer. But the early spring notes of the great tit are an exception: this loud clear ringing call of " *Tēē'-cher, Tēē'-cher, Tēē'-cher,*" heard even in January, is one of the earliest and most unfailing " signs " of spring.

The blue tit is perhaps the best known of all, with his blue and blue-grey above and his pale yellow beneath; the great tit, with his black head, white cheeks, and bold yellow underparts faced with black, is the most handsomely coloured; the cole tit and the marsh tit are studies in black and grey, the difference being that the former has a band of white running down the back of the head, whilst the head of the marsh tit is all black.

All these four tits share the family habit of nesting in holes—in walls, in trees, and sometimes in the strangest situations; *e.g.* in a rain-pipe, a street-lamp standard, or a postal pillar- or wall-box. To nest in a hole is generally of great advantage to a bird; his treasures are protected by being out of sight; the entrance being small, no larger bird can get in; and the nest, being supported by the sides of the recess in which it is placed, need not be so large or so firmly built. Moreover, the young birds cannot fall out of the nest before they are able to fly, as so many do in open nests. For these reasons, birds that nest in holes are generally more successful in bringing off their broods than those that place their nests in open situations.

A small bird of the garden of quite different quality is the tiny brown Wren—Jenny Wren or Kitty Wren as he has been affectionately named. He is a lonely bird, intimate only with himself. Yet he is thoroughly happy and contented, and, for his size, he is one of the finest, loudest, and most persistent singers we have. His sudden burst of song sounds like a hearty volley of overflowing jollity; and in his song, as in all his ways of life, he is the "Mark Tapley" of the bird world. He is thoroughly endowed with the spirit of independence. You may throw out the crumbs for the robins and the sparrows, the scraps for the finches, but the little wren disdains them all: and though he loves your garden, he will keep his distance, and allow no familiarity. He can forage for himself even in the hardest frosts of winter. He builds a large-sized nest of dried grass, moss, or of leaves, and roofs it in with an elegant dome. It is cleverly made and often well disguised, though at other times rather conspicuous; sometimes he builds an extra nest to sleep in himself while his mate is hatching out her eggs.

Another plain brown bird of the garden, one also which seeks no other society than that of his mate, is the Hedge Sparrow or Hedge Chantie, as he is called. But he is not a sparrow at all, either in his build, his plumage, or his habits, for he is one of the most modest and retiring little birds we have. He loves shelter and concealment, but, when all is quiet, he is fond of hopping about in the garden or along the path, picking up small particles of food. He is an early nester, either in the garden hedge or the faggot stack, and a sight of his large nest of moss, leaves, and twigs, cosily lined, and with its beautiful blue-green unspotted eggs, forms one of the joys of spring:

> "On me the chance-discovered sight
> Gleamed like a vision of delight,"

sang Wordsworth, and many others have experienced that thrill of pleasure at finding it. The hedge sparrow sings a fine little warbling song, full of sweetness and the joy of spring.

Of the finches that haunt the garden—the chaffinch, greenfinch, bullfinch, and goldfinch—we have no space to speak, nor of a late summer visitor, the Spotted Fly-catcher (see Plate XIII., *a*); and of the field birds near the house, we shall have to be content with just naming the glorious skylark, the partridges, and the rooks, as also the linnets, bramblings, and yellow-hammers which flock thither in search of food in winter.

CHAPTER XVIII

BIRDS OF THE WOODLANDS

To the birds, the attraction of the woodlands, the parks, and the hedgerows is supreme, and more, both of individuals and of species, find sanctuary there than in any other feature of our scenery. Think of the rich variety of cover and shelter the woods offer, both in summer and winter. Their close-set ranks of tall and stately trees, their growth in middle height of hawthorn, holly, blackthorn, and a dozen others, their patches of evergreen shrub and bramble, the thick-set undergrowth of bracken and brier, and the ground tangle of summer vegetation—these offer every variety of attraction that the rarest and shyest of birds could desire.

From late spring onwards, they teem with insect food easy of capture; supplies of water are seldom lacking; they offer an infinite variety of nesting sites; among the

close-set ranks of trees and shrubs, such enemies as the deadly sparrow-hawk are baffled in pursuit. Therefore the woods form the haunt of a wonderful variety of bird life, from the stately heron to that midget of British birds, the goldcrest, which is only 3½ inches from beak to tail! Residents, Summer Visitors, and Winter Visitors all find food and congenial quarters.

Let us glance first at some of the larger species which, for the most part, nest high in the trees. Largest of all our inland birds is the Heron, 3 feet in length and with a wing-spread of 6 feet. Though he seeks his prey by stream and lake and marsh—his long legs, his long neck, and his long bill have all been developed for success in fishing—he usually nests in small companies in a wood or a belt of firs, thus forming a "heronry." He is a social bird at nesting-time; and though at present I know of no heronry in Hertfordshire, he may often be seen in the county.

Of the Owls (the nighttime birds of prey) there are, in addition to the White or Barn Owl already mentioned, three other species haunting the woodlands. These are, (1) The Wood Owl, Brown Owl, or Tawny Owl, the bird whose "merry note, Too-whit, Too-whoo," several times repeated, forms the only owl-music known to most people; (2) the Long-Eared Owl of the fir copses; and (3) the Little Owl, a bird of more open country and one that has only within recent years been introduced into Britain. These generally nest in holes well up in the trees, or in the deserted nests of Crow or Magpie, save that the little owl, which is more of a day-bird than the others, prefers lower situations; often in the pollard willows that border many of our rivers.

The hawks, on the contrary, are day-hunting birds; and both Kestrel and Sparrow-Hawk nest mostly in the woods, making their rough platform nests of sticks high in the trees. But while the Kestrel loves the open country as his hunting-ground, the fierce and daring Sparrow-

Hawk is always a woodland bird, hunting the hedgerows, the coppices, and the open glades for his victims. He is indeed a real terror to the small birds, especially when he has his own hungry brood to feed.

While the Owls and Hawks make life a constant tragedy for many of the little creatures of wood and field, the Wood Pigeons, with their gentle cooings and their timorous ways of life, have just the opposite nature. They include the Ring-Dove, easily known by the patch of white feathers on either side of the neck; the Stock-Dove, a smaller bird; and the summer visiting Turtle-Dove, smallest, gentlest, and most attractive of all, with his crooning song —one of the most soothing voices of the summer woods. All the doves make the simplest of nests—a thin, rude platform of twigs: so slim and shallow that one wonders the two eggs do not roll off, or that the weight of the birds does not bring the nests tumbling to the ground. The stock-dove, however, is fond of nesting in holes—especially in rabbit burrows.

Then we have the lordly Pheasant and the more soberly coloured and long-billed Woodcock, though in our county the shy woodcock is a winter visitor only. Both are ground-haunting and ground-nesting species (see Plate XV., *b*); though the pheasant roosts at night in the middle heights of the trees, and crows excitedly to let all the wood world know it is bedtime. But the woodcock becomes more active as night falls; he is more of a night-bird than the pheasant, and betakes himself to the damp ground to feed, using his long bill in probing for worms and other dainty morsels.

Finally, among the larger birds of the woodlands, are the Crow family: the Carrion Crow, the Rook, the Jackdaw, the Magpie, and the Jay. Taking once again the "family view," we notice that the Carrion Crow, the Rook, the Raven, and the Jackdaw are mostly black-

feathered; and that Magpie and Jay have developed coloured plumage. The Rook lives in flocks all through the year, as witness his "rookery"—one of the busiest scenes in all the wild life of each spring. The Jackdaw also nests in companies in the seacliffs or in those inland; in the woods he prefers a more solitary site; and, alone of his kind, he always places his nest *out of sight*, in a hole in a tree, in the church tower, or even in the chimney-pot. Carrion Crow, Magpie, and Jay also prefer to nest in solitude, the two former building large nests high in the trees, the Jay hiding his smaller nest in the very heart of the fir trees in the wood. The Magpie is peculiar in that he is the only one of the Crows that has found it desirable (*a*) to grow an unusually long tail and (*b*) to make a roof over his nest as a shelter, leaving a hole at either side of this for entrance.

Looking next at the woodland birds of medium size, at least two of our rarest and shyest are included. These are the Green Woodpecker or Yaffle, a bird more than a foot in length; and the Greater Spotted Woodpecker, nearly 10 inches long. The former is a handsome bird in green and gold with crimson crest; the latter is in black and white—beautifully barred or "pied," and with splashes of brilliant red. The woodpeckers are not perching birds, but rather climbing and clinging birds, having two toes forward and two backwards: their tail feathers, too, are stiff and pointed, and by being pressed close against the bark in climbing, they help to support the birds. Woodpeckers are insect-feeders, and for nesting sites they excavate holes in the trunks of trees.

Our birds of medium size include the starling, the three thrushes we found nesting in the garden or orchard, and, in addition, two winter visiting species which frequently seek the shelter of the woods in hard weather. They are the Redwing and the Fieldfare—thrushes which migrate

from the Continent in immense flocks in the autumn, and return in the following spring. Nor should we omit the Nightjar, a summer visitor that is often found nesting in the woods, though he is more frequently heard on the quieter commons and heathlands.

Coming to the smaller residents of the woods, there are several hole-nesting species in addition to the Lesser Spotted Woodpecker. They include our four tits, the great, the blue, the marsh, and the cole tit ; and also the Nuthatch and the Tree Creeper. The Redstart, or Fire Tail, and the Wryneck are birds of the summer only, which also have the hole-nesting habit. For the most part the holes of all these are not so far up as those of the woodpeckers. Most of them, too, like to take possession of a ready-made hole, rather than hew one for themselves. And when the nuthatch has found one that is suitable, he often plasters most of the entrance up with mud, leaving a hole just large enough for himself and his mate to use.

And the little Tree Creeper, whose mottled brown and grey plumage is so like the bark of the trees on which he lives, has copied the woodpecker and turned his tail into an organ for support in climbing. And yet he belongs to the Perching birds and not to the Climbers. Both he and the nuthatch and the wryneck are just as clever as the woodpeckers themselves in going vertically up and down the trunks of trees.

Several of the finches are birds of the woods at one time of the year or another. The chaffinch, greenfinch, bullfinch, hawfinch—all nest among the trees as well as in garden and orchard ; so also does the tree sparrow. And least of all our woodland residents is the tiny Goldcrest, the daintiest of them all. He suspends his beautiful little nursery cradle beneath the slender twigs of an evergreen—fir or yew in the woodland, or cedar on the lawn. So small

and light is he that it takes six of his kind to turn the scale at an ounce !

Our chorus of woodland birds is increased in spring and summer by the golden-voiced Warblers that return from beyond the seas to nest in the same English woods and lanes and hedgerows in which they were born. What a goodly company they make : the Nightingale, queen of song ; the Blackcap, second only in richness and eloquence (see Plate XIII., *d*) ; the Garden Warbler, the Redstart, the Greater and Lesser Whitethroats, and the Sedge Warbler ; down to the three dainty little warblers of the high trees, the Chiff-chaff, the Willow Wren, and the Wood Wren.

All are lovers of the woodlands and the hedgerows, seeking the quietude which these afford. While nightingale and blackcap, garden warbler, sedge warbler, and greater whitethroat find seclusion in the lower bushes, and for the most part pour forth their golden melodies from such recesses, the redstart prefers as nesting-site the still deeper seclusion of a hole in tree or wall. And the lesser whitethroat, perhaps the least numerous of them all, haunts the higher trees and seeks a more elevated site for his nest. Usually all these make fragile, cup-shaped nests : the nightingale almost on the ground, the others at a little height above it, using in the structure thin round stems of grasses, threads of moss, and a lining of fine hair.

Those of the three small leaf warblers—chiff-chaff, willow wren, and wood wren—are different in design and blend more perfectly with their surroundings. For these birds roof in the cup-shaped hollow with a deftly woven dome of dried grass, leaving the entrance hole at the side : all are placed on the ground among the grasses, and the dead leaves which carpet the woodlands. The nests of chiff-chaff and willow wren are lined with feathers ; that of the wood wren, rarest of them all, with fine hair instead.

CHAPTER XIX

BIRDS OF THE COMMONS AND HEATHS

HERTFORDSHIRE has a wealth of commons and heathlands: wide stretches of unenclosed country relieved here and there with clumps of trees and masses of gorse. In the more elevated districts, these open areas develop into the drier heathlands of heather and bracken. Those that lie low in the river valleys become more or less water-logged or marshy, forming stretches of rough, rush-grown moor. Elsewhere the commons are overgrown with dense thickets of bramble and scrub.

Among the birds of the gorse-grown areas, the Stonechat or Furzechat is thoroughly at home with the conditions of life the common affords. Strolling across it on any spring morning, you are almost certain to see the male stonechat, flitting nervously across from spray to spray of gorse, and clinking out his sharp, anxious little "*t'chat-t'chat*"—a sound roughly imitated by gently striking two pebbles together, from which the *stonechat* derives his name. His black head, ruddy breast, and white collar set him off finely (see Plate XIII., *b*); these, with his habit of constantly flicking his tail, and of giving out his rather musical note, make him easily recognisable. His nest is, as a rule, deeply and cleverly hidden among the undergrowth, and, like that of the whinchat, is very difficult to find. The eggs of both chats are of a greenish-blue colour, with faint rusty-brown markings round the larger end.

The Whinchat, his next-of-kin, is also a bird of the common, though equally at home in the grass of the meadow, or among the plentiful cover usually to be found on the railway embankment. But this species is only a

summer visitor—the stonechat is a resident ; and the male whinchat, though a beautiful bird, is not so boldly coloured : he may be distinguished by his broad white eye-stripe, his generally browner and lighter colour, and by his call note of "*ū'-tck-ū'-tck, tack'-tack'-tack'*" ; and he does not display himself so prominently as the stonechat.

Another small bird of the gorse and brambles of the common is the cheery little Linnet—the red or brown linnet, as he is called, to distinguish him from the green linnet or greenfinch. The linnets are exquisite little songsters and are residents and seed-eaters, though, like most finches, they feed their young on softer food. The linnet's nest is a slight little structure cosily lined. It is just as frequently built in low trees, even in the garden, as it is in the gorse. The male, too, is a handsomely coloured bird, with his breast of mottled crimson or carmine.

The Yellow Hammer or Yellow Bunting is another handsome bird, fond of the gorse for roosting and nesting quarters, and his finely streaked and daintily marked eggs are very distinctive. But he haunts the open country almost everywhere, especially on the fringes of the corn-lands. His brilliant yellow colouring, his leisurely flitting from perch to perch—he is often to be seen on the telegraph wires—his happy-go-lucky little song, "*A-little-bit-o'-bread-and-NO-cheese,*" are thoroughly in keeping with the note of high summer.

Then we have the Long-tailed Tit, who is remarkable for his great length of tail, for it is actually longer than the rest of his body. Underneath he is softly tinted in rose colour, and this, blending with the black and grey and greyish white above, gives him a dress quite unlike that of any other bird. But the feature which most distinguishes him is the exquisite nest he builds ; and he is one of the early builders, making his nest either in the gorse

or in the blackthorn before the leaves are out. It is rather a large structure for a small bird, shaped something like an inverted bottle—hence the bird's name of "bottle tit"—domed above and with the entrance at the side. It is wonderful for its constructive skill, its luxurious lining of feathers (for no less than 2379 were found in one nest), and the beautiful and artistic finish which it shows. For it seems to be spangled and silvered all over with tiny pieces of white and grey-white lichen and delicate lines of spiders' webs of an almost silky lustre.

On the more open parts of the common, where the rough, coarse grasses are thickly set, the Meadow Pipit or Titlark finds its favourite haunt. He is a little bird of plain olive-brown and grey, streaked and dappled with buff and white, and therefore almost the same colour as the grey-brown grasses he loves to haunt and among which he weaves his well-hidden nest. He is very much like a sky-lark, only a shade smaller, and a shade darker in tint; and, like the skylark, he can almost make a little crest of the feathers at the back of his head. Like him, too, he is largely a bird of the ground. And, more than any other bird of the common, he is made the victim of the cuckoo's wiles. The cuckoo is very fond of the open common, and carefully watches the pipits when going to and from their nests. Then, when the birds begin to lay, the cuckoo visits their nests, lays her own egg within, and extracts one of the pipit's eggs, which she destroys. And this she will do at a dozen different nests, if she can find so many. When the baby cuckoo is hatched, he throws out of the nest the eggs or young of the rightful owners, so gaining for himself all the attention and food these would have bestowed upon their own nestlings. There is no stranger story in all bird life than that of the cuckoo and the birds he dupes; but it is too lengthy a story to relate in detail here.

The pipits are near relatives of the wagtails, though their coloration is entirely different; and their tails are shorter and not in such a state of perpetual motion. But among the points they have in common are that they are elegant little birds; they place their nests on the ground; they can all run very prettily; they do not hop; and they all display a fine white edging on each side of the expanded tail. A second member of the group is the Tree Pipit, and is very much like the titlark in colour and appearance. But he is a much better singer, and his wonderful "flight-song" is quite unlike that of any other inland bird, though his seaside relative, the rock pipit, has a similar song.

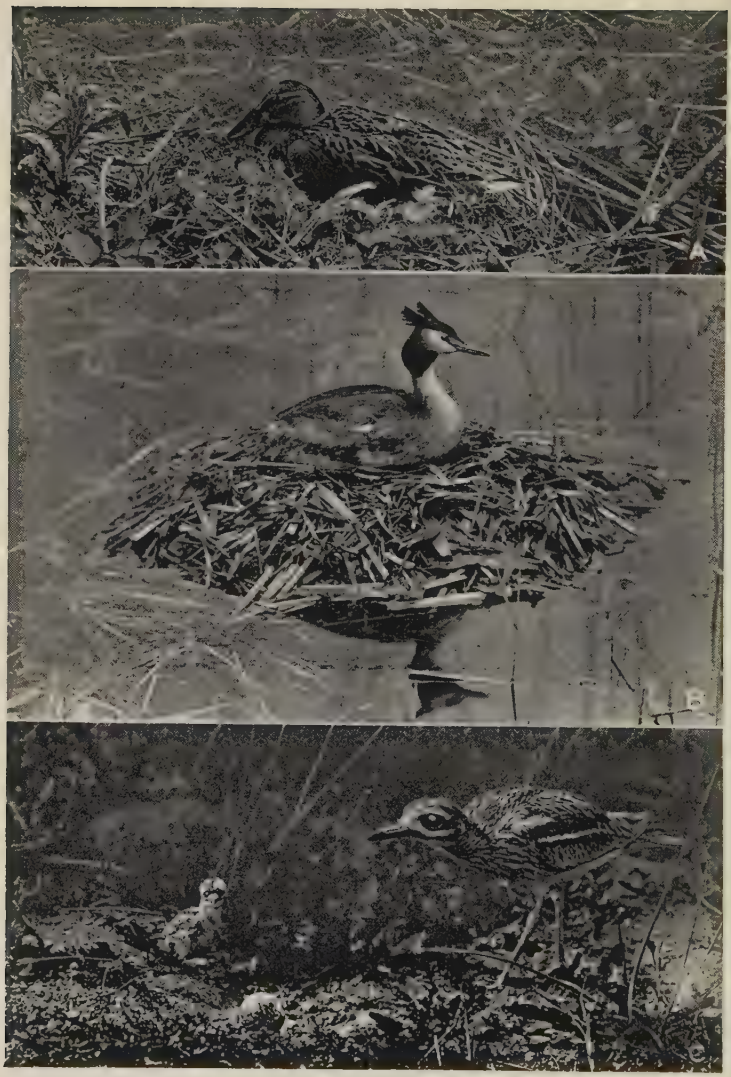
The grass and tangle of the common is the chosen haunt of another summer visitor, the Grasshopper Warbler, another plain bird of warm brown and grey, though he is effectively barred and mottled in various tints. He has obtained his special name because, to most ears, his curious song sounds like a continuous chirping of that insect. At early morn or late at eve this warbler's song is at its best; though as the bird, like the corncrake, is said to be something of a ventriloquist, it is not easy to locate the singer. The grasshopper warbler is a small bird; matches his colours with his surroundings, and is a lover of solitude. He is seldom seen; and his well-hidden nest, generally placed at the end of a short "run" in the thick grass, is extremely difficult to find.

Finally, there is one bird that seeks and enjoys the solitude of the night as well as that of the common; and that is the Nightjar. He is one of the latest summer visitors to arrive in England; he is akin to the woodpeckers, the wryneck, the kingfisher, and the swift, though he differs from all these in laying his two elongated eggs on the bare ground among the bracken or the stones, and without making either nest or hollow to receive them. He dozes out his days crouching either on the ground or



(*a*) Reed Warblers at Nest.

(*b*) Pheasant's Nest.



(*a*) Mallard, or Wild Duck.
(*b*) Crested Grebe on Nest.
(*c*) Stone Curlew.

lengthwise along the branch of a tree; but in the dim light of the gloaming he rouses himself, partly, perhaps, because the insect prey on which he mostly feeds, the cockchafers and beetles, are also creatures of the night. He has the curious habit of striking his wings together overhead as he flies, and what passes for his song is a strange performance, challenging the weirdness of the night: it consists of a long-rolling, crooning "*churr-r-r-r-r-r-r*," varied only by being chanted on two different notes one a little higher than the other; the change from one to the other is repeated at frequent intervals. His pearl-grey eggs, blotched with darker purple-grey, frequently resemble the stones among which they are laid; both the down of the chicks and the plumage of the adult birds are so exquisitely mottled in colour that they match both with the bark of the trees and the bracken tints of the ground on which the birds rest and build. In a word, both eggs, chicks, and adult birds are coloured protectively, as an aid to concealment.

The Lapwing, the Partridge, the Pheasant, and many smaller birds visit the common at some time of the year or other, but space forbids any further mention of their habits here.

CHAPTER XX

BIRDS OF THE WATERSIDE

Near Hertfordshire's rivers are acres of water meadows, and here rich supplies of insect and other soft food, such as worms, are to be had for the probing: snipe and redshank and peewit and others take their toll. The water shrinks during the drought, and the mud that is left abounds with small shell-fish: these attract birds both

large and small. The young of nearly all our smaller birds are fed on insect or other soft foods ; as these are all more abundant within easy reach of the waterside, that consideration may prompt many birds to nest in the river valley, or among the rushes and reed-beds that fringe the lake or the stream.

A stage beyond the birds that merely haunt the waterside—the birds *about* the stream and yet not *of* it—brings us to those like the gorgeous little kingfisher, and—a giant bird in comparison—the sober, stately heron. These depend for the most part upon the fish that live within the water. The kingfisher, which haunts in small numbers almost every stream in the county, plunges boldly down into the water to capture his minnows, spending his whole existence up and down the stream, the dyke, and about the lake ; and mostly he makes his " nest " in a hole in the bank, burrowing for the purpose. The heron, on the other hand, patient, grey fisher-bird as he is, wades into the water and waits, still as a statue, until with a fierce stroke of his powerful spear-like bill he secures his fish. But he does not nest about the water : he prefers a safer holding in the crown of a tall tree—by preference a fir—which may be miles away.

Another step brings us to the birds which not only take their food from the water, but which also can paddle or swim about its surface, or can dive down within it and travel underneath for some distance—though again, there are differences or special adaptations for the aquatic life even among these.

The Waterhen, or Moorhen, for example, divides its preferences almost equally between land and water ; it is equally at home on both. It can paddle, swim, and dive well (and it is not web-footed) ; it can run quickly over the grass ; it can fly swiftly and low, though somewhat heavily, along the line of the stream ; and has thus three

modes of locomotion. It is equally at home on the smallest pond and the largest lake, and will make its nest in the fringe of reeds or flags bordering its stretch of water. Sometimes it even nests in a tree. Its near relative, the Coot, a bird of similar build and habit, though it can accommodate itself to both, prefers the life on the water to that on the land; its claws are lobed or partly webbed; it can both swim and fly more strongly than the moorhen, and more boldly ventures out into the open water of the lake. It is not so partial to the stream or to *running* water generally. Both birds weave a large basin-shaped nest of flags or other water vegetation; and they anchor it safely, high and dry, to the reeds or sedges. Both lay a large number of eggs, and, in each case, the young birds are able to take to the water soon after being hatched. The white frontal "shield," which seems to prolong the upper surface of the bill, is very conspicuous, and easily enables you to identify the coot. He is sometimes called the bold coot from this very fact.

The same habit of early taking to the water obtains with the baby ducklings; and "to swim like a duck" sums up the chief activity of the tribe. The duck is most at home on the water; its webbed toes are its specially developed swimming apparatus. But it does also come ashore and walk, or rather waddle. It has a comparatively large and heavy body to carry about on short, stumpy legs; and that is the whole secret of waddling. The geese you see on the common are awkward pedestrians for the same reason; while as for the swan you have only to compare his easy and graceful movements on the water with his awkwardness on the land, to realise that in the ability of his legs to carry his body gracefully he is worse off than either of his smaller relatives.

Some of the ducks, moreover, have gone a stage beyond mere swimming, and have acquired the art of diving

under the water for their supplies of food. So they are divided into two classes, Diving Ducks and Non-diving Ducks. Five kinds of wild ducks have been known to nest at the large reservoirs near Tring: the Mallard (see Plate XVI., *a*), the Teal, the Shoveller, the Tufted Duck (see Plate XIV., *a*), and the Common Pochard: of these, the two last-named are Diving Ducks; the other three are surface-feeders.

The ducks, too, along with the geese and swans, have bills quite unlike any other birds you will see on your rambles. These are broad, stout, and lengthy; and generally "flatten out" more or less towards the rounded end. This type of bill is really a *straining* apparatus. When the birds are on or about the water, they pass or "dabble" large quantities of water through their bills; and a plated arrangement inside enables them to strain the solid animal or vegetable material on which they feed from the water.

Lastly, we come to the birds that are best adapted of all for the aquatic life—the Grebes: *the* diving birds *par excellence*; for not only are they experts at plunging down into the water, but *they can travel considerable distances underneath it as well.* They dive into the water for their food, and for some at least of the material of which they build their nests; they love diving for the simple pleasure of the sport; they will dive in order to hide themselves on the approach of enemies. They can get about by flying, by swimming, by diving, but as their legs are placed well back on their bodies they are not well equipped for walking. What they have gained in becoming experts at swimming and diving, they have lost in the power of walking.

Our county is fortunate in having two of these expert divers living and nesting within its borders. They are the Little Grebe or Dabchick, which is not uncommon on our rivers, and the Great Crested Grebe, which is one of the

handsomest birds of Britain. It lives and nests in some numbers on the large reservoirs near Tring, where, happily, it is rigidly protected. Both are extremely active birds in their native element; both make their nests of collections of reeds, flags, and other water vegetation, the nests floating on the surface though anchored to the growth around and beneath, and generally soaked with the water (see Plate XVI., *b*). If disturbed while sitting, the grebes rapidly cover up their eggs with some of the loose material of the nest, before diving off into the water. And the baby grebes after hatching are very soon able to take their first header into the water, though they like to scramble on to their mother's back and so make their earliest voyages of discovery more safely.

Among the smaller birds that often haunt the waterside, mention may be made of two of our summer visiting warblers: these are the Sedge Warbler and the Reed Warbler. Neither species can be said to be common, yet neither is really scarce, where the surroundings it loves are to be found. The sedge bird is the more abundant. He is a noisy little bird, and frequently indulges in nighttime performances. Among our small birds he is one of the best mimics; he reels off his loud chatter of song, and brings into it the notes of other birds with which he is familiar—the sparrow, the chaffinch, the blackbird, and the swallow, for example.

His near relative, the Reed Warbler, is not so common or so well known, and although he prefers, as his summer home, the seclusion of a thick reed-bed, he will also, as our illustration shows (see Plate XV., *a*), nest now and then in the bushes or low trees near the waterside. There he builds a nest which is one of the most skilfully built in bird architecture. The materials, dried grass or reed "blades," with "reedfeather" for a lining, are deftly woven around or among three or four of the vertical stems or twigs growing

up from the water, producing when complete a perfect little cradle slung to the reeds and with no other support. The nest is deep and snug; and unfortunately for the family of its little builders, it is frequently one of those victimised by the cuckoo. With the reed-beds for a playground, this little warbler is an expert acrobat, slipping gracefully from stem to stem, sliding down one and running up another, or sometimes clinging with one foot on each of two adjacent reeds.

Away back in the rush-grown water meadows about the stream, lies the haunt of a handsome little bird, the Reed Bunting, or Reed Sparrow; though with his glossy black head and throat, his fine white collar, and white edging to his tail feathers, he is a much finer bird than the house sparrow. Actually he is not a sparrow at all; he is a bunting—a relative of the yellow-hammer we saw on the common; building much the same type of nest in a bunch of rushes or rough grass; laying somewhat similarly blotched and streaked eggs; and singing also a jerky, monotonous song of one note, repeated four or five times, with a sharp little uplift at the end.

Another handsomely coloured little bird of the water meadow is the Yellow Wagtail; but he is only a summer visitor, while the reed bunting is a resident. It is not a little curious that, of our three commoner wagtails, one, the pied species, is a resident; the second, the grey wagtail, is a winter visitor only to Hertfordshire; while the third, the Yellow Wagtail, only comes to us for the summer season.

In conclusion, I have only space to mention that in a short stretch of river land bordering the Colne not far from my own home, there nest every year the reed bunting, the yellow wagtail, the whinchat; and also those two larger and related Plovers, the snipe with his long legs and his probing bill, and the gay and handsome peewit.

CHAPTER XXI

THE BIRDS OF THE DOWNLANDS

You have read of the upland belt of the Chilterns and of the broad open aspects of these hills and downs. These features offer ideal conditions to certain birds, which love to haunt the wide horizons and the lonely solitudes. It was the line of these Chalk hills, with the warrens and brecks of East Anglia beyond, that gave sanctuary to the largest and finest of British inland birds; one, however, that has long been extinct, namely, the Great Bustard, a bird which, perhaps, most resembled the farmyard turkey. This magnificent bird measured 4 feet from bill to tail; had a wing-spread of 8 feet; and was anything from 22 to 32 lb. in weight. But, alas! its conspicuous size, the extension of plantations into the habitudes that it loved, the bringing of more and more of these into tillage, and, most effective of all, the "lust to kill" of the man with the gun, led to its gradual extermination. The last of our native bustards were killed in Norfolk in 1838: of the last of our Hertfordshire representatives we have the sad record that, at the beginning of the nineteenth century, when one was seen in the neighbourhood of Royston, "the whole population turned out to shoot it, but without success"; and it eventually disappeared—doubtless to meet with the same hostile reception elsewhere.

Fortunately we still have left, as native to the wide uplands of the Chiltern Hills, another fine Hertfordshire bird, the Stone Curlew. Formerly he was to be found in small numbers all along the line from Tring to Royston;

but as the solitudes he loved so much have been more and more invaded, so he has continued to retire; and at no distant date we fear we shall have to place him, too, on the list of nesting species that have vanished from our county.

The Stone Curlew is a summer visitor to England, and reaches his Hertfordshire haunts early in May. He belongs to the large and widespread Plover family, of which the peewit or green plover is the best known member. He is called also the Norfolk Plover, the Stone Runner, the Thick-knee, and the Thick-kneed Bustard. He is a bird of large size, being about 16 inches in length; and he is the largest plover found in Europe.

One would naturally expect that the birds inhabiting long stretches of downs would be essentially *birds of the ground*; and this the stone curlew is. His varying shades of grey and brown, beautifully mottled and barred, tone in colour with the ground, *i.e.* his colours are protective; he obtains his food—slugs, snails, worms, with now and again a mouse or a frog—from the ground; he sleeps on the ground; hides on the ground, and nests there. In a slight hollow scratched in the chalky or flinty soil, as you may see in the illustration (see Plate XVI., *c*), the two eggs are laid. In shape they resemble the stones and flints among which they are frequently placed; in colour and markings they also blend well with their surroundings: thus are they doubly "protected."

Most stone curlews nest on the higher slopes of the downs, and can thus see the approach of an enemy from afar; when disturbed they run along the ground for some distance before taking wing. If the intruder does not follow, they may never rise from the ground at all, and thereby escape observation. When the danger has passed, they return to their eggs in the same secretive way; with head kept low they creep slowly through the

short herbage of the downs, just as you see the bird in the picture is doing.

Their powers of running have gained for them the name of Stone Runner; and under many circumstances the bird prefers to run rather than to fly—though he can fly well, as becomes a migratory bird. If you look carefully at the picture, you may notice that this *habit* of running is connected with the *structure of the body*. The stone curlew has developed legs and feet of unusual length and power.

He is specialised, too, in other ways. He lies low and keeps quiet in the daytime; and this, together with his colour resemblance to his surroundings, renders him inconspicuous. But when evening falls he rouses himself to activity; runs about with his mate; flies abroad to his feeding-grounds in the meadows, and becomes vocal, calling out his name, *cur'-lēē*, *cur'lēē*, or *cour'lēē*, *cour'-lēē*, so that all the hills may hear. Like the owls, he is a bird of the twilight and the dark; his habit is nocturnal, and this is shown in our photograph by his large, well-developed eye.

In the picture you may note (*a*) the egg of the bird; (*b*) the chick in its first coat of down; and (*c*) the mother bird approaching her treasures. The colours of all three are in harmony with their environment.

Another bird native to the north-eastern part of the Chalk hills of our county, and one that formerly nested more plentifully there, is the little Wheatear. He, too, is a summer visitor—a relative of the stonechat and whinchat. He is much smaller than the stone curlew, and yet, because of his habits, he is more conspicuous. He will move along the downs just in front of you as you walk, yet always keeping just out of your reach; a little bird in grey and white and brown, settling on any little prominence—a molehill, for example—which may offer him a point of vantage. His white underparts flash in the light

as he flits along, as does also a large white patch of feathers at the root of the tail. His sprightly ways and his sharp call of *chat-chat*, or *tack-tack*, uttered loudly and anxiously if you are near his nest, or if his young are about, easily enable you to identify him. But his nest, different from most downland birds, is always placed in a hole ; in a heap of stones ; in a stone wall if there is one ; or, finally, in a rabbit's burrow.

These two, stone curlew and wheatear, are the typical birds of the downs, though neither of them is plentiful in our county. Indeed, the downland districts do not support so large a bird population, either in individuals or in species, as, for instance, the lower woodland districts do. Food is not so plentiful, water is scarce, and cover or shelter, save for the few ground-haunting birds, is lacking. Yet there are several other interesting birds, either about the downs themselves, or on the foothill slopes beneath, which should be included in this group.

There are the Partridges, for instance—the Common and the Red-legged—with their diminutive cousin the Quail ; all ground birds, and able to run very quickly. The quail, however, is a summer visitor only, and is one of our rarest and least known birds ; as is also the Landrail or Corncrake ; both birds haunting especially the cornlands adjacent to the downs, where their movements are difficult to follow. As a rule it is only by their voices that we know they are there.

The Peewit or Lapwing is another of the larger birds found in the upland districts ; though his nesting range is a wider one, and he is perhaps more numerous elsewhere. He is to be found in the water meadows, the cultivated fields, the open parkland, and in the springing corn. I have even found his nest on a railway embankment, within 8 feet of the metals and with trains going by every few minutes. Though he is so unlike the stone

curlew in many ways, he is very like him in others ; and this we should expect, as both are Plovers in the wide sense, and should display in some measure the family relationships. But the peewit always makes a nest, rough and simple though it be (see Plate XIV., *c*) ; the curlew is content with a mere scraping ; the peewit lays four eggs instead of two ; he is a day bird rather than a night bird, is with us all the year round, and has strongly marked colour contrasts in his plumage : glistening black and glistening white, with almost metallic greens and browns above, that make a fine show in the sunlight. Most distinctive of all :

> " In the spring the wanton lapwing
> Gets himself another crest."

He is a loud-voiced bird too ; if you venture on his nesting grounds when he has young about, the adult birds simply " make the welkin ring " with their piercing cries of anxiety. And sometimes alighting on the ground and feigning an injured wing, they will try to lure you farther and farther away from their treasures.

Here and there about the downs are groups or belts of trees, among which the dark-crowned firs often prevail. These small fir groups are the haunt of another bird that is little known—the Long-eared Owl, a mystery bird of night. He is so named from two lengthy tufts of feathers growing erect on his head, though they are in no way connected with their owners' ears. This owl makes his nest high up in the trees in a squirrel's drey, or the old nest of hawk or crow ; but after dark he hunts the open country for the " small deer " of downland which form his prey.

Another bird of prey, though this time of diurnal habit and a hawk, also loves the wide sweeps of the downs. He is the Kestrel or Windhover, and his special feat is that of climbing, with the aid of the wind, a spiral course to a

considerable height; and, hovering there with beating wings, he searches the ground with his keen eyes for mouse or vole or other prey—a mere speck it may be from such a height. Then he swoops down to the capture like a bolt from the blue, and very seldom does he miss his "quarry." Having once seen this wonderful feat, one understands the origin of the saying, "An eye like a hawk!" Finally, there is a bird of passage that used to make the Chiltern Hills one of his resting-places for a day or so on his spring migration to the north; and again on the return journey in the autumn. This was the Dotterel, a bird of the Plover family, which now only nests on the mountain fells of Lakeland and of Scotland, and even there in sadly diminishing numbers. His presence on the Hertfordshire Hills has not been recorded for several years, though, time ago, he came as regularly as the seasons. And with this mention of him our brief account of the upland birds of our county must conclude.

APPENDIX

EXERCISES AND OBSERVATIONS

1. Make lists of the birds around your town, village, or countryside that are found—
   (*a*) All through the year;
   (*b*) During the spring and summer months only;
   (*c*) During the autumn and winter months only;
   and add to these lists from year to year.
2. When you have made your list of "Summer Visitors," prepare a separate table, showing—
   (*a*) The earliest date in spring in which you see or hear each species.
   (*b*) The latest date in autumn on which they are in evidence.
   Keep this record going from year to year.

3. Carry out the same plan with the "Winter Visitors" that may come to your district.
4. Try to recognise or identify as many of the birds as you can—
   (*a*) By their songs, call notes, or alarm notes.
   (*b*) By the colours and arrangement of their plumage.
   (*c*) By their manner of flight.
   (*d*) By the respective habitats in which you may find them.
5. When you have found any birds' nests write an account showing—
   (*a*) The situation in which they are placed.
   (*b*) The materials used in their construction.
   (*c*) The number, colours, and markings of the eggs, and their different shapes.
   (*d*) The dates on which the young birds are hatched out, and the dates on which they are able to leave the nest.
   (*e*) The kinds of food on which the adult birds feed them.
   (*f*) How the colours of their plumage change as they grow older.
6. Take up the study of, say, half a dozen or more birds that are with us all the year round, *e.g.* the Song Thrush, the Hedge Sparrow, one (or more) of the Tits, one (or more) of the Finches, the Skylark, the Water-hen, and the Peewit. Notice their habits and ways of life at different seasons of the year.
7. As far as you can, try to study the birds in families, *e.g.* Thrushes, Wagtails, Tits, Finches, Crows, Ducks, Plovers, Grebes. Notice especially how the various members of the same family (*a*) resemble and (*b*) differ from each other.
8. Make as many notes as you can of the kinds of food that different birds eat, and notice especially any that are (*a*) harmful, (*b*) beneficial to the interests of the farmer and the gardener.
9. Notice year by year the different kinds that appear to be (*a*) more common or (*b*) less plentiful.

GLOSSARY

Alluvium.—Water-borne matter deposited by rivers, usually in low-lying, flat areas.

Ammonites.—Fossil shells, found in the Gault (and other formations), and so called because of their resemblance to the coiled horns on statues of the deity Jupiter Ammon, often represented as having a ram's head.

Amphibia.—A class of animals which live partly in water, partly on land. In their earlier stages they breathe by means of gills, in later stages by lungs.

Botany.—The study of plants ; the science dealing with the life of plants.

Calcium Carbonate (or **Carbonate of Lime**).—A well-known chemical compound composed of calcium, carbon, and oxygen. The formula is $CaCO_3$.

Carbon Dioxide.—A well-known gas, present in small quantities in the air. It is a dioxide of carbon. The formula is CO_2.

Cereals.—Grasses which yield grain for food, or the grain so produced.

Chalk.—Generally used for a soft white or greyish white limestone : almost entirely composed of calcium carbonate. School " chalks " are not usually true chalk.

Climate.—The average condition of a place as regards winds, rainfall, and temperature ; that is, the average condition of the atmosphere and results thereof.

Conglomerate.—A rock composed of rounded pebbles, naturally cemented together.

Contour (line).—A line connecting points on the surface (of the ground) having the same elevation ; and used particularly of the lines drawn on a map to represent these.

Coppice.—A thicket or grove of small trees.

Coppiced.—Cut back so as to produce shoots from old stumps.

Deciduous.—Applied to trees having leaves which fall off at certain seasons . . . as distinct from evergreens.
Diurnal.—Active by day, as distinct from **nocturnal.**
Dormitory.—A sleeping-place.

Echinoderm.—A class of marine animals including the star-fishes and sea-urchins.
Echinoid.—A sea-urchin.
Ecology.—That branch of botany which deals with the relationships of plants to their environment.
Environment.—The surrounding conditions and influences.
Eulogy.—An expression of great praise.

Flint.—A non-crystalline form of silica (SiO_2), commonly found as nodules and less frequently as layers in the chalk.
Fossils.—Remains, impressions, or traces of animals or plants of past geological times found in rocks.

Geology.—The science dealing with the history of the earth, as this is learned from a study of the rocks.
Glaciers.—A body of ice formed in a region of perpetual snow, and moving slowly to lower areas, usually down a mountain-side or down a valley.
Gradient.—The rate of regular ascent or descent, in the case of roads, railways, etc., usually expressed as the number of feet ascended or descended in a known distance.

Habitat.—The natural, suitable home of a plant or animal.
Herbal.—An old name for a book describing plants.
Herbarium.—A collection of dried plants, usually mounted and classified—also the place where the collection is kept.
Hertford.—In addition to the meaning given in Chapter VI., the name is sometimes said to be from "Herudsford"—"the red ford"—as it was spelt in the **Domesday Book.**
"Hundreds."—Old divisions of shires. A "hundred" is variously thought to have been the area where a hundred families or warriors lived in Anglo-Saxon times, or to have contained 100 hides (old measures of land).

Labiatæ.—A natural order of plants having flowers with two unequal lips, such as lavender, mint, dead-nettle; the name means lip-like.

Mammals.—Animals whose young are suckled by the mother.

Meander.—A winding or turning in the course of a river. The word comes from Mæander (now Menderey), a river in Asia Minor noted for its windings.

Metropolis.—Really a mother city—the chief or capital city of a state.

Noctule.—The name of a common English bat, so called from its nightly or nocturnal habits.

Nocturnal.—Active by night, as distinct from **diurnal.**

Ooze.—A soft mud or slime, often used particularly for the soft deposits covering large areas of the ocean floor.

Orographical.—Strictly means "showing mountains,"—applied to a map which shows the height of the land in different parts of an area.

Papilionaceæ.—A natural order of plants having flowers somewhat resembling a butterfly, as the pea, etc. The name means "like a butterfly."

Parasite.—A plant or animal which lives on, in, or with some other (called its "host"), at whose expense it obtains food, shelter, etc.

Pudding Stone.—See Conglomerate.

Reservoir.—A place where anything is kept or stored, used especially of a place where water is collected and stored for future use, as for canals, town supplies, etc.

Rhizome.—An underground stem sending leafy shoots from the upper surface, and roots from the lower side.

Serotine.—A rarer bat than the Noctule, but the name means much the same, the meaning of serotine being "late in the day or season," or "tardy."

Shire.—Shorn or cut off; used especially in the sharing up or cutting of kingdoms.

Spicule.—A small, slender, pointed body—used especially for the spines of a sea-urchin, or the slender rods which support the soft parts of sponges.

Stratified.—Rocks laid down in layers or beds.

Stratum (plural, **Strata**).—Strictly a layer, used especially for a layer or bed of rock.

Swallow-Holes.—Holes where streams disappear or have disappeared into the rocks; commonest in limestone regions.

Trefoil.—Strictly three-leaved, but used to describe a leaf of three lobes, as clover.

Umbelliferæ.—Bearing umbels; **umbels**—like little umbrellas or shades. A natural order of plants.

Vegetarian.—Strictly means one who believes that only plants should be used as food—sometimes used to describe an animal which is herbivorous, or lives only upon plant-food.

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